EXHIBIT DX2

TO DECLARATION OF PETER J. GOSS IN SUPPORT OF DEFENDANTS' MOTION TO EXCLUDE THE OPINIONS AND TESTIMONY OF GARY SETTLES, PH.D.

UNITED STATES DISTRICT COURT

DISTRICT OF MINNESOTA

- -

In Re:

Bair Hugger Forced Air Warming

Products Liability Litigation

This Document Relates To:

All Actions MDL No. 15-2666 (JNE/FLM)

- -

DEPOSITION OF GARY S. SETTLES, Ph.D.

VOLUME I, PAGES 1 - 352

JULY 18, 2017

(The following is the deposition of GARY S. SETTLES, Ph.D., taken pursuant to Notice of Taking Deposition, via videotape, at the Hyatt Regency Pittsburgh International Airport, 1111 Airport Boulevard, in the City of Pittsburgh, State of Pennsylvania, commencing at approximately 9:34 o'clock a.m., July 18, 2017.)

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P R O C E E D I N G S

(Witness sworn.)

GARY S. SETTLES, Ph.D.,

Called as a witness, being first duly sworn, was examined and testified as follows:

EXAMINATION

BY MR. ASSAAD:

Q. Please state your name for the record.

A. Gary Stuart Settles, S-E-T-T-L-E-S.

Q. Dr. Settles, my name is Gabriel Assaad and I represent over 2500 plaintiffs in this multidistrict litigation, and I'm going to ask you numerous questions today regarding your expert report.

Do you understand that?

A. Yes.

Q. Have you ever had your deposition taken before?

A. No.

Q. So this is the first time.

A. First time.

Q. Okay. Then I'm going to go through some ground rules. First, I'm going to ask you numerous questions, and you said you understood that; correct?

A. Yes.

Q. Okay. If you don't understand my question, please let me know.

A. Yes.

Q. Understand? Okay.

If you answer the question that I've asked I'm going to assume that you understood it. Fair?

A. Yes.

Q. Since this is your first time I'd like to remind you that there is a court reporter taking down everything we say, and therefore wait until I finish my question before you answer, and I'll wait while you're finishing your answer before I ask another question. Fair?

A. That's fair.

Q. Okay.

A. Could I just ask about the -- how certain technical jargon would be handled with the court reporter? Is it okay to spell these words out, or --

Q. If you want to spell it out, you can; otherwise during a break she will ask us how to spell certain words if she doesn't know how to spell them.

A. I understand.

Q. First and foremost can we agree that during your testimony today you will not be guessing about anything? Fair enough?

A. Fair enough.
Q. Both sides don't want any guessing. We want reliable expert testimony. Do you understand that?
A. I understand.
Q. Okay. Now you understand that you've been designated as an expert in this case by the defendants.
A. (Nodding.) Yes.
Q. And as an expert, you understand that you are to be objective in your opinions. Fair?
A. I understand that.
Q. You're not supposed to be an advocate for either side, but offer objective expert opinions based on your education, training and experience. Do you understand that?
A. Yes.
Q. Okay. You understand that you are -- in this deposition you are -- it is similar to being in trial and all the testimony you are giving today is under penalty of perjury. Do you understand that?
A. I do.
Q. Now at any point if you realize that any testimony you give is -- is not correct, wrong or false, this is the time to correct it at any time during the deposition. Fair enough?

A. Yes.
Q. Now the purpose of this deposition is for the plaintiffs to understand the full scope of your opinions. Do you understand that?
A. Yes.
Q. Okay. And in litigation this is our one time for us to ask you questions under oath and obtain all the opinions you have with respect to general causation in this case. You understand that.
A. "General causation."
Q. Yes. Let me -- Let me -- There's -- Forget about --
This is the one time I have to ask you about all your opinions so far in this case that you have formulated. Do you understand that?
A. Opinions relevant to this case.
Q. Yes.
A. Yes.
Q. Okay. As well as I have a right to understand the methodologies used by you to formulate your opinions. Do you understand that?
A. Yes.
Q. Okay. Now you have done -- you have done research in the past; correct?
A. Yes.

Q. Okay. And you've used your technique, the schlieren technique, which is S-C-H-L-I-E-R-E-N -- And that word will be used a lot so I'm spelling it now.
THE REPORTER: Thank you.
Q. You've used the schlieren technique many times in the past; correct?
A. For the last 50 years.
Q. Okay. And you've written extensively on schlieren; correct?
A. I have.
Q. Okay. And with respect to research and studies performed by schlieren you usually have a methodology that you would use with every type of paper you've written; correct?
A. A methodology of the operation of the optical instrument, or -- I'm not quite understanding what you mean by "methodology."
Q. For example, when you do a -- a scientific study you sit down and you form a methodology of how to perform the study.
A. Yes.
Q. And how would you define "methodology"?
A. It's what I just asked you, but it would be a plan of action to use an instrument, in this case we're talking about the schlieren instrument, in order

to image and better understand natural phenomena.
Q. And would it be fair that before you perform any scientific research or study you have a hypothesis?
A. Well this needs some discussion, because in some circumstances you are investigating a phenomenon so your hypothesis would be this is what's happening, and then you would either -- your further work would then either approve or deny that hypothesis. But in visualizing a flow it's not necessary to have a hypothesis about -- always necessary to have a hypothesis about what the flow is doing. It's only necessary to have the tools available to render an image and -- or a video, and then to produce that and observe the flow. Once you observe the flow is the time to start developing -- developing hypothesis, it looks like this, or it looks like that kind of a phenomenon.
Q. Okay. So the hypothesis could come either before you observe the experimental data or after.
A. Correct.
Q. Depending on the type of study. Fair?
A. Correct.
Q. Okay. Was there a hypothesis in this case that you formulated or were told prior to performing

your work?
A. No. We -- The plan here was to use the schlieren instrument, apparently for the first time, to observe the airflows associated with laminar downflow as -- such as would be in an operating room, and interacting with patient-warming blankets. And since other flow visualization methods had been used but not the schlieren technique, it was important to first get some evidence, get some images and video, and to try then from that evidence to understand the flow phenomenon that's happening.
Q. Okay.
A. So I did not go into this with a particular hypothesis about an airflow interaction with a patient-warming blanket.
Q. Fair enough. And you said "the first time." This is the first time the schlieren's been used with a Bair Hugger?
A. As far as I know.
Q. Okay.
A. With a patient-warming blanket, let's not narrow that down to a particular brand.
Q. Okay. With a patient-warming blanket?
A. Yeah.
Q. What are patient-warming blankets?

A. Patient-warming blankets, as I understand them, are medical devices that applied to a patient during surgery in order to keep the body from undergoing hypothermia, keep the body warm.
Q. And you tested two patient-warming blankets in your study; correct?
A. I did.
Q. One was the HotDog and one was the Bair Hugger; correct?
A. Yes.
Q. And they're two patient-warming blankets but just different designs; correct?
A. Different principles.
Q. Okay. One uses conduction and one uses convection mainly; correct?
A. Well one uses conduction and one uses forced air; convection if you like, yes.
Q. Okay. Forced air is --
(Interruption by the reporter.)
Q. Well forced air is convection; correct?
A. Yes.
Q. Okay.
A. It's a type of convection.
Q. Okay. So same product, different design; correct?

Same ultimate product purpose, different design; correct?
A. Same purpose, different design.
Q. Yeah. Okay.
You used the term "laminar flow" just now; correct?
A. Yes.
Q. What is laminar flow?
A. I think for today's purposes there have to be two definitions. The first definition, the scientific definition, is a flow in which the molecules form layers and -- and move smoothly over one another; that is to say, not turbulent flow. That's the scientific definition. The -- However, there's a terminology in clean room and operating theater work that can be a little confusing, and that is that the ceiling is fitted with louvers and there is a downflow, and the downflow has, in principle, more or less straight streamlines so it produces a waterfall-like airflow down onto the operating table. And this is referred to at least in clean room technology, and I've seen it also in the operating room papers, as laminar flow. But in fact the Reynolds number of the airflow is high enough Reynolds number that the flow is actually turbulent, not

laminar by scientific definition. So I want to answer your question that way in order to avoid confusion.
Q. Okay. So in the world of engineering the term "laminar flow" as compared to "turbulent flow" is dependent on the Reynolds number; correct?
A. Yes.
Q. Okay. With respect to our discussions today you're going to use a different definition depending on the type of flow in the operating room or a clean room as compared to turbulent flow; correct?
A. Well there's certainly turbulent flow present in an operating room and a clean room, but I'm just talking about the terminology that's used for this idea of producing a downflow in which the streamlines are essentially straight.
Q. What's the difference between an operating room that is a laminar flow and an operating room that's a unidirectional flow?
A. A laminar flow --
A laminar downflow in this case is a unidirectional flow in the downward direction.
Q. Okay. So you -- they're synonymous?
A. Not exactly.
MR. GOSS: Object to form.
A. You could have a unidirectional flow that's

horizontal.
Q. Okay. You can't have a laminar flow that's horizontal?
A. Yes. But laminar in the sense of straight streamlines, not in the sense of no turbulence.
Q. Okay. Have you ever designed an operating room?
A. No, sir.
Q. Have you ever done any studies in an operating room?
A. No, sir.
Q. You're a member of ASHRAE; correct?
A. I am.
Q. You're a member of ASME?
A. I'm a fellow of ASME.
Q. So the answer to my question is "yes"?
A. Yes.
Q. Okay. Now my understanding is that your main opinion in this case is that the Bair Hugger device does not disrupt the unidirectional airflow from above; correct?
A. In my expert report we show images of experiments that were done with a unidirectional flow from above, and we show Bair Hugger and HotDog patient-warming blankets. And neither of those two

produce significant disruption of the flow from above.
Q. So are you saying they do disrupt the downward flow?
A. There is a layer of --
Q. "Yes" or "no," sir?
MR. GOSS: Let him finish his --
Q. "Yes" or "no," then you can give an explanation.
MR. GOSS: Let him finish his answer.
Q. Okay. I want a "yes" or "no."
MR. ASSAAD: Let's not get started, Peter. I'm talking about the production --
MR. GOSS: You're not going to bully another retired Professor Emeritus. Let him answer the question.
MR. ASSAAD: He's sitting in this -- He's sitting in this deposition, he needs to answer my questions.
Q. "Yes" or "no"?
A. I need to hear your question repeated.
(Record read by the reporter.)
A. There's no yes-or-no answer to that question. It's not amenable to a "yes" or a "no." I can answer --
Q. So you have no opinion one way or the other

with -- with --
A. Sir, --
Q. -- a definite opinion.
A. -- what happens cannot be described by a yes-or-no answer to that question. If you'll allow me, I'll explain what I mean.
Q. That's all I need. If you can't answer "yes" or "no," that's fine.
So the next question I have is: All your opinions are in your expert report; correct?
A. Yes.
Q. Which expert report are we talking about, the revised one, or the one submitted June 1st, 2017?
A. Well my expert opinions were first submitted June 17, and then there was a revision that corrected a couple of items. So they both have my expert opinion, but a couple of issues were -- I discovered were corrected.
Q. What did you discover?
A. Upon re-reading the report after a couple of weeks I discovered that the figure and the discussion associated with the downflow generator quoted an accuracy that was unrealistic based on the measurements, so I corrected it.
The second one was that one figure in -- in

the report that showed flow around -- beneath the surgical table and around the feet, when I wrote the report I was under the impression that the downflow was on when that experiment was done, but the logbook suggests that that's not the case. This generated enough question about that particular image that I removed the image and the discussion thereof.
Q. So my understanding is you removed the image and the discussion regarding the effect of the Bair Hugger at the -- below the drape, below the table of the drape because you were not sure, when you conducted that study, whether or not the downflow generator was on or off; is that correct?
A. That particular issue.
Q. Okay.
A. In all other cases I was sure.
Q. When you say "all other cases," what do you mean by "all other cases"?
A. Every other example illustrated by schlieren images in the report. It was only --
Q. Is there -- Is there a video of a schlieren image with the downflow generator on of the feet of a particular person?
A. No, sir.
Q. Okay. Are there still pictures of a

schlieren image with the downflow generator on of the feet area or the lower area?
A. No still pictures.
Q. Okay. So sitting --
(Interruption by the reporter.)
Q. So my understanding is is that you have no evidence or data with respect to the effect of the Bair Hugger device with the downflow generator off at -- at the feet area of a person.
MR. GOSS: Did you mean to say "on," the downflow generator on?
MR. ASSAAD: Yes.
[Outside interruption.]
Q. Let me -- Let me strike that question.
My understanding is that you have no evidence with re -- with the -- with respect to the effect of the Bair Hugger with the downflow generator on at -- at -- below the operating room table.
A. No schlieren evidence, no.
Q. Okay. So the only evidence you have is the temperature testing.
A. Correct.
Q. Okay. Any other corrections, after preparing for today's deposition and reviewing your report, that you want to make right now?

A. No, sir.
Q. Okay. Have you reviewed any expert reports by the plaintiff?
A. Two expert reports by the plaintiff.
Q. And that would be Dr. Elghobashi and Dan Koenigshofer?
A. That's right.
Q. Okay. Are you aware of any opinion by the plaintiffs exper -- any of the plaintiffs' experts that compare the HotDog to the Bair Hugger?
A. No.
Q. Are you aware of any opinions by any of the plaintiffs' experts that used the schlieren technique in evaluating Bair Hugger?
A. No.
Q. Are you aware of any opinions by any of the plaintiffs' experts that discuss the heat generated by the power units of the Bair Hugger compared to the HotDog?
A. No.
Q. So would it be fair to say that all -- all of the opinions that you've formulated regarding these three issues, the HotDog versus the Bair Hugger, schlieren technique, and the power units that genera -- heat generated by them by the Bair Hugger and

HotDog are all original opinions by you and not rebuttal opinions?
MR. GOSS: Object to form.
A. I don't know what a rebuttal opinion is.
Q. Well you agree that no one of plaintiffs' experts offered any opinions on those issues that you're aware of.
A. That I'm aware of, no.
Q. It's my understanding you charged a flat fee of $70,000 to perform your testing and report?
A. That's not correct. I -- This work was done by a small business, and the flat fee was charged by the business, not me personally.
Q. Okay. Let me rephrase that.
You work for a company called FloViz; correct?
A. FloViz, Incorporated.
Q. Okay.
A. It's a very small business.
Q. Is it a small business?
A. Very small business.
Q. How small?
A. Four people.
Q. Okay. And who's the president of the company?

A. Lori Dreibelbis.
THE WITNESS: Should I spell that?
THE REPORTER: No.
THE WITNESS: Okay.
Q. And what is your position?
A. I'm scientific and re --
My actual position is director of research.
Q. And what's your compensation there?
A. Do you mean in general, or in this case?
Q. Do you get a percentage of this case, or do you get just a salary?
A. Neither, actually. I expect to be paid for my consult -- or my fee for testimony, but it has yet to be established whether there will be any other compensation.
Q. So it's my understanding that 3M has paid FloViz, Incorporated $70,000 for the study; correct?
A. That was the agreed-upon rate.
Q. Okay. Has 3M paid $70,000?
A. There are still outstanding invoices.
Q. Okay. Is that -- Are you aware of -- Are -- Do you deal with that part of the business?
A. I try not to. I'm the scientific person.
Q. Okay. And out of that $70,000 it's my understanding that you don't get paid any of that

money?
A. Well I don't know yet. It hasn't been established.
Q. Who decides --
A. We haven't even --
Half of the $70,000 is not yet received, and it will be decided by the company what -- how much will be paid to individuals.
Q. Well how many hours did you spend yourself on -- on performing the tests in this case?
A. I didn't keep a count of hours.
Q. Can you give me an approximation?
A. It would be a guess, and you've told me not to guess.
Q. Well this time I'm asking you to guess.
A. All right. So the approximation would be based on the experimental logbook which you have a copy of, and you will see there that we worked a number of days, and I would make the approxi --
Q. Nine days to be exact; correct?
A. Nine days.
Q. Okay.
A. And we worked typically a half a day, which is all morning or all afternoon, so four and a half days, and that would be four people, and one of them

was me.
Q. Okay. When you say --
When you say a half a day, we're talking about four hours a day?
A. I think it was rather longer than that, probably six hours.
Q. Six hours a day. So --
A. Now these were the actual testing. So there was much more time spent in putting together -- designing apparatus, putting together apparatus and so forth, and I'm not able to give you an estimate of how many hours were spent there.
Q. Okay. And were you there every single day testing was done?
A. I was.
Q. Okay. So nine days, six hours a day, so looking about 36 hours of testing?
A. That's just the testing, yes.
Q. Okay. And how much time would you approximate in actually setting up the apparatus and doing what you just discussed?
A. That would be a guess, and I'm not going to guess.
Q. More than 10 hours?
A. Certainly.

Q. Huh?
A. Certainly more than --
Q. More than 20 hours?
A. I think you're asking me to guess.
Q. I'm asking you to guess in this situation. Give me an approximation.
A. You told me just a few minutes ago not to guess.
Q. When it comes to your scientific opinions I don't want you to guess. When I'm asking you about how many hours you spent working on a study that your company charged $70,000, I request an approximation.
MR. GOSS: You can answer if you -- if you have an understanding of how much time was spent.
A. The only thing I could do would be to sit down and go back over the process in my mind, spend some time to make some notes about it and try to make an estimate. But right off the top of my head now, I had not thought about how many hours, I was not keeping track of hours, it was -- the idea was to get the job done.
Q. Do you work for free?
MR. GOSS: Object to form.
Q. For FloViz?
A. That's a complex answer. I get

reimbursement for some things I do, and don't get reimbursement for other things.
Q. Such as?
A. Well such as I'm -- I'll be paid a consulting fee for testimony today.
Q. Are you getting paid the entire $600 an hour --
A. Yes.
Q. -- for your testimony?
A. Yes.
Q. What about for the work you do for FloViz on this study? How is your compensation?
A. Well that will be charged through FloViz, everything will be, but the compensation through FloViz is more complicated. I've been paid on some things, and on other things I have donated my time. It's a small business, it's -- we're building, and therefore I sometimes donate my time.
Q. Do you own any shares of FloViz?
A. It's privately held.
Q. Do you own any percentage of FloViz?
A. No.
Q. You own zero percent.
A. Zero percent.
Q. Okay. Do you have any relationship with

anyone at FloViz?
A. Working relationship, not personal relationship.
Q. So it's my understanding that there is a possibility out of the $70,000 that FloViz is receiving from 3M in this case you might get paid zero dollars from that; is that correct?
A. I don't know. I expect to be paid something, but we've not discussed an actual amount.
Q. Do you have a contract with FloViz, Inc.?
A. No.
Q. But are you saying you are going to get paid -- I mean, is there a possibility that you might not get paid anything out of the 70,000?
A. Possible.
Q. Who would I need to depose to figure out your compensation with respect to this project?
A. Lori Dreibelbis is the president of the company.
Q. Did she work on this project?
A. Yes.
Q. And I guess she is married to Larry P. Dreibelbis?
A. She is.
Q. Is he vice president?

A. No.
Q. What's his position?
A. Insofar as this project was concerned he acted as a technician.
Q. With the company what's his position?
A. I don't know that he has a position with the company.
Q. Okay. Does Lori Dreibelbis own 100 percent of the company?
A. As far as I know, yes.
Q. How long you been working for the company?
A. The company was established approximately two years ago, and I began to work with them then.
Q. So you started with the company when the company was established?
A. Yep.
Q. Okay.
A. And I should point out, to be completely accurate, that the name FloViz, Incorporated was established by me many years ago in the 1980s just myself, and it was pretty much dormant for the entire period from then until 2015 when I retired. I then transferred that to Lori Dreibelbis because I'm not interested in running a company, she was.
Q. What was your --

What was your compensation for transferring the name?
A. One dollar.
Q. Prior to the 3M project -- I'm going to call this the 3M project -- what other projects did you work for with FloViz?
A. There were several projects. I don't know -- How do you wish me to identify these?
Q. When you say "several," more than five?
MR. GOSS: And I guess I would ask, are you talking about since 2015 when he sold the company to Lori, or going back to when he first started the company?
Q. Since he went -- started working for there two years ago.
A. All right. So what information do you want about these projects?
Q. Give me the names of the -- Give me the names and your clients.
A. In one of those cases I've been instructed not to name the source of the funding. I can tell you what the project was about.
Q. What was the project?
A. The project had to do with schlieren imaging of leaks of natural gas.

Q. What's another project you worked on?
A. The rest were consulting issues on SBIRs. SBIR is a Small Business Independent Research project with companies that were working on abrasive blasting, companies called Figure Engineering, and I have to think a moment, IFOS Incorporated, which is a company that does fiber optics.
Q. And those were consulting projects?
A. Those were basically consulting, but they were handled through FloViz, Incorporated.
Q. Okay. And so would it be fair that the only schlieren testing you've done was for the leaks, --
A. Natural gas leak project.
Q. -- natural gas leaks?
A. In the -- In the last two years, yes.
Q. Okay. Does FloViz, Incorporated own schlieren mirrors, or do you rent them?
A. We own schlieren mirrors.
Q. Okay. So all tho -- all the equipment you used in this case was owned by FloViz, with respect --
A. All the equipment --
Q. -- to the schlieren stuff.
A. Yes. All the schlieren equipment.
Q. And the camera.
A. And the camera.

Q. Okay. I assume the Bair Hugger was given to you by 3M.
A. Yes.
Q. Okay. And that was a Bair Hugger 775?
A. 522 I believe.
Q. I'm talking about the blower.
A. 775 is the blower.
Q. And the blanket was the 522?
A. Yes.
Q. How many blankets did you receive?
A. I don't know the exact number. Several blankets.
Q. More than 10?
A. Less than 10.
Q. More than 5?
A. I don't know.
Q. Did any of them break when in use?
A. No.
Q. Any other equipment given to you by 3M?
A. There was the loan of equipment, an electrocautery device. 3M also provided a HotDog blanket.
Q. Excuse me?
A. A HotDog blanket.
Q. Okay.

A. I think that's all we received from 3M.
Q. Okay. Did they give you any surgical drapes?
A. Surgical drapes, you're right. I forgot that.
Q. How many surgical drapes did they give you?
A. Less than five. Less than five sets.
Q. Did you give --
And what kind of sets were they?
A. I don't know what kind of sets. I don't understand that, what you're asking for.
Q. Well were they a surgical drape set for a neurosurg -- a neurosurgery or --
A. Oh, all right. Hip and knee surgery, if I recall.
Q. And it said that on it?
A. I'm not sure what it said on the box.
Q. Were they 3M drapes?
A. I'm not sure who the manufacturer of the drapes is.
Q. Did you test the drapes in any way?
A. We used the drapes in the --
Q. Did you test the drapes?
A. We did not test the drapes.
Q. Okay. Did you test the --

Did you test the drapes in any way or do any calculations with respect to heat conduction or whether or not they're permeable or not?
A. Did not.
Q. So you've done no testing on the drapes; correct?
A. We've done testing that used the drapes.
Q. That wasn't my question, sir.
You did no testing --
A. I did no testing on the --
Q. -- on the drapes. Okay.
A. -- individual drapes. No.
Q. So just so it's clear for the record, you have done no testing on the drapes; correct?
A. That is correct.
Q. Okay. You've performed many scientific studies in your career; correct?
A. I have.
Q. And you've written many peer-reviewed articles; correct?
A. I have.
Q. Would you agree with me that if a scientific study is not reproducible, it's not reliable?
A. Reproducibility is a tenet of scientific studies, so I agree with that.

Q. Okay. So you agree with this ter -- with this phrase: If a scientific study is not reproducible, it is not reliable. Correct?
A. I'll agree with that.
Q. In fact, during the peer-review process if the reviewers do not understand the methodology they will usually send it back for clarification from the author; correct?
A. That's one thing that can happen, yes.
Q. I understand. But if the -- if the reviewers do not understand the methodology or if it's unclear, they will most likely send it back to the author for clarification and to edit the manuscript; correct?
A. At the very least it would go back for clarification.
Q. Okay. Because methodology is very important; correct?
A. It is.
Q. Okay. I mean, with improper methodology you would have unreliable results; correct?
A. I don't understand what you mean by "improper methodology."
Q. Well if you have a messed-up methodology or no methodology, there's no way for someone else to

reproduce the results, and therefore they'd be unreliable; correct?
A. I agree with that.
Q. Okay. And when you -- one way to establish a methodology is to prepare protocols for a study; correct?
A. A test plan, yes.
Q. Test plan protocol; correct?
A. Yes.
Q. Did you perform a test plan or protocol in this case?
A. I had a test plan in mind, yes.
Q. Did you write it on paper?
A. No.
Q. Okay. So besides what's in your mind, there is nothing written or documented regarding a test plan; correct?
A. What is written --
MR. GOSS: Object to form.
Q. You may answer.
A. It's covered in my expert report the methodology and the approach that we took.
Q. You agree with me that -- Okay.
Did you have a test plan in this case?
A. I had in mind a test plan.

Q. Okay.
A. Does not necessarily have to be written down on paper.
Q. I never said it had to be written down.
My question to you is that you had a test plan.
A. I had a test plan.
Q. And it's not written down anywhere; correct?
MR. GOSS: Object to form.
Q. Is it written down, "yes" or "no"? Simple question.
A. It's embodied in my expert report.
Q. Okay. Is it written down in anything else besides your expert report?
A. No.
Q. Okay. And your expert report came after you conducted the tests; correct?
A. Correct.
Q. So there was no test plan written down before you conducted the tests; correct?
A. No.
Q. So my -- the answer to my question is: "Yes, that's correct."
A. That's correct. Yes.
Q. Now you agree with me that when you are

formulating a test plan to do a comparison study such as this case, Bair Hugger versus HotDog, you want to limit the amount of external variables that could affect the results; correct?
A. As much as possible, yes.
Q. Okay.
A. Correct.
Q. For example, if you want to compare how the Bair Hugger affects the environment, and I -- the best ideal situation is to have an environment that is completely constant, not changing, and just turn the Bair Hugger on and off; correct?
A. Yes.
Q. If there are other things changing in the environment, such as people moving, other things blowing around, that would affect the results and would make it much more difficult to ascertain the effect of the Bair Hugger on the environment; correct?
A. Yes.
Q. Now you agree with me that if you want to determine how a device interacts with a system you need to model that system as accurately as possible; correct?
A. Sorry. I --
Q. If you want to see a device --

If you want to determine how a device interacts with a system; an environment, whatever, you need -- you want to model that environment and system as accurately as possible; correct?
A. That's not necessarily correct. It's possible to have a less than -- for example in the case of an operating room to have less than the complete operating room airflow in order to look at the effect of downflow on warming blankets.
Q. Let's go back to Engineering 101. What, in your education, training and experience, do you believe would affect air currents in a room? If you know.
A. What would affect air currents in a room.
Q. Umm-hmm.
A. Like this room.
Q. Yes. Let's take this room for example.
A. There are louvers in the ceiling that are providing air, and I assume that the air is being removed somewhere, although I can't see exactly.
Q. So an air supply and an air return. Fair enough?
A. Well, those are -- that's how the room is ventilated.
Q. Okay. Anything else?

A. If that's what you're asking me.
Q. Anything else that would affect the airflow in this room?
A. As you already mentioned, if people are moving around that would affect the airflow in the room.
Q. Anything else?
A. Heat sources.
Q. Anything else?
A. That's about it.
Q. Walls?
A. The walls are static.
Q. You don't think the walls cause any type of --
A. The walls constrain the flow, but that's not the same thing as the other items that you asked.
Q. So you don't think when the air blows and it hits a wall there's some sort of reaction with the airflow that --
A. I do not understand your --
Q. Do you under --
A. -- question.
Q. Do you understand airflow in fluid dynamics?
A. I'm an expert in fluid dynamics.
Q. You consider yourself an expert in fluid

dynamics? Okay.
A. Experimental fluid dynamics.
Q. What about theoretical fluid dynamics?
A. I know some fluid --
I know theoretical fluid dynamics, but my ex -- specific expertise is as an experimentalist.
Q. And who calls you an expert, besides yourself?
Has a Court ever determined you as an expert in experimental fluid dynamics?
A. A court?
Q. Uh-huh.
A. Not as far as I know.
Q. Has any --
Have you ever won any awards in experimental fluid dynamics?
A. Yes.
Q. So you understand that walls affect -- could cause turbulence in a room such as this; correct?
A. I don't think that's the proper phrasing of what happens.
Q. Okay. So what happens when the airflow hits a wall? You have a vent coming out and air -- air hits a wall. What happens?
A. In other words, if the air comes out from

the louver and goes over and --
Q. Yeah.
A. -- hits the wall.
Q. Yeah.
A. The air, depending on temperature, could turn -- could turn down the wall, it could be stagnated. There are several things that could happen.
Q. So if there's no wall there, nothing's going to happen; correct?
A. So, you know, you asked me what determines the airflow, and the walls obviously determine the airflow in a room, the size and shape of the room and so forth.
Q. That's all I'm asking you, sir.
I said: The walls have an effect on airflow; "yes" or "no"? That's true, --
A. The walls --
Q. -- you just said it.
A. -- constrain you.
MR. GOSS: Hold on. Wait for him to ask you a question.
Q. The walls will affect the airflow in the room. I'm not saying how it's going to affect the airflow, but it has an effect on the airflow in the

room; correct?
(Interruption by the reporter.)
Q. The airflow affects --
The walls affect the airflow in the room; correct?
A. They constrain the airflow in the room.
Q. And that has an effect --
A. Yes.
Q. -- on the airflow.
A. Yes.
Q. Very simple question, sir.
And in fact you agree with me that even a room such as this there are so many things that affect it that it's a complex system.
A. Yes.
Q. Even me talking has an effect on the airflow in this room; correct?
A. I would say that's a very small effect.
Q. I didn't quantify the effect.
It has an effect on the airflow; "yes" or "no"?
A. Yes.
Q. Okay. And if you do a study you want to account for as many of the items that can affect a complex system; correct?

A. Not always correct.
Q. So you don't want to perform a study that is as accurate as possible?
A. I didn't say that.
Q. So when would you not want to perform a study and make it as accurate as possible to a real-world condition?
A. Can we go back a couple of questions? You wanted -- I think you asked me --
Could I have read back when you perform a study you want to include as many effects as possible?
MR. GOSS: No. You don't get to ask to have something read back.
If you're unclear about something he asks you, then -- then you can ask him to rephrase, but otherwise --
THE WITNESS: I'm sorry.
MR. GOSS: -- just do your best to answer his question.
A. Well --
Q. I could read the question over.
I said: And you -- you'd want to do a --
You'd want to account for as many of the items that can affect a complex system; correct?
A. And I believe my answer to that was "not

necessarily always correct."
Q. Okay. And one of the reasons why you're saying that today is because you know, sitting here today, that you did not account for many of the items in an operating room that would affect airflow; correct?
A. We did a simulation of a downflow interacting with a surgery table as described in my report. We did not attempt to simulate everything associated with an operating room.
Q. But it wasn't even close to what was in an operating room; correct?
A. It was a simulation --
Q. What's your term of --
What's your definition of a simulation?
A. Well a simulation in the sense the airflow -- laminar downflow interacting with the -- a mannequin on a surgery table. It's not an actual clean room airflow or an actual clean room surgery setup, it's an experimental simulation.
Q. Well let's go one by one.
You agree that room dimensions will have an effect on airflow.
A. They can have.
Q. I'm not quantifying it or giving like it has

a big effect or a small effect. I just want to know if it's going to have an effect.
A. Yes.
Q. Okay. Room pressure has an effect on the airflow in a room; correct?
A. You mean barometric pressure?
Q. Yes. Whether it's positive pressure or negative pressure.
A. Yes.
Q. Because if it's positive pressure air will leave through leaks or underneath the door, and if it's negative pressure air will be pulling in from the door; correct?
A. Yes.
Q. Okay. So it has an effect.
A. Or from not necessarily the door, but from any leaks, --
Q. Yes.
A. -- any cracks or whatever.
Q. Every room has leaks; correct?
A. Yes.
Well not every room. Most rooms.
Q. Temperature will have an effect on airflow; correct?
A. That depends.

Q. Well if there is a --
I'm not saying it does in every case, but it can have an effect --
A. It can have an effect, yes.
Q. Okay.
A. Certainly.
Q. For example, as you showed in your testing, a flame which is very hot is going to have an effect on the airflow around the flame; correct?
A. Yes.
Q. Okay. The mass flow of the air supply is going to have an effect on the airflow in the room; correct?
A. "The mass flow."
Q. Yes.
A. In terms of, for example, air changes per hour in a clean -- in an operating room.
Q. If I have a very low amount of mass coming out of the vents --
A. Yes, okay.
Q. -- as compared to a very high, it's going to have an effect.
A. Yes.
Q. Air return, where the air returns are on the sides are going to have an effect on the airflow;

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correct?
A. In a room like this, yes.
Q. The number of people in a room is going to have an effect on the airflow; correct?
A. Again, yes.
Q. Surgical lights in an operating room is going to have an effect on airflow; correct?
A. Yes.
Q. The overhead lights will have an effect on the airflow; correct?
A. In an operating room or --
Q. Yes.
A. I'm -- I'm not sure what effect the overhead lights have, but they could have an effect.
Q. Even in this --
If you put a schlieren mirror over there you're going to see some movement, correct, right below that light.
A. Fluorescent lights?
Q. Yeah.
A. It's possible.
Q. Well is there a range -- temperature range where schlieren is not going to pick up density differences?
A. Schlieren doesn't show you the temperature,

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it shows the gradient of the refractive index.
Q. And the refractive index is based on density; correct?
A. It's directly related to --
Density is directly related to the refractive index.
Q. Okay. So you're saying that there's no density difference from the heat being produced by those fluorescent lights?
A. There probably is.
Q. Okay. Is there a minimum temperature gradient or Delta that schlieren will not be able to see?
A. Yes.
Q. What?
A. That depends on the optical system.
Q. Okay. Let's use the one that you used in this case. Will it be able to see the difference of one degree?
A. It has to be --
It's looking for a gradient. It has to be a temperature difference over a distance.
Q. Okay. So what would it be in this case?
A. Much less than one degree per centimeter.
Q. One degree per centimeter?

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A. Less than one degree per centimeter.
Q. Okay. So the Delta has to be less than one degree per centimeter.
A. If -- In order not to see it.
Q. Okay. In order not to see it.
A. Yeah. If it's greater than that you will see something.
Q. When you --
A. And I think it's probably much less than that.
Q. Okay. Is there --
And how do you determine that number?
A. There's a calculation in my book that shows how you can determine the minimum threshold of visibility.
Q. And when you --
Just so I understand, what is one degree per centimeter?
A. That's a temperature gradient. It's a change of one degree over a distance of one centimeter.
Q. Okay. So, for example, if I have a one degree change over 10 centimeters --
A. Umm-hmm. That would be a tenth of a degree per centimeter or one tenth of the value we were

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discussing.
Q. And schlieren will not see that; correct? Or it would be very difficult.
A. Once again, it depends on the optical system. If you have a sensitive optical system you'll certainly see one tenth of degree per centimeter at atmospheric conditions.
Q. Okay. So the system that you used, do you know the exact degrees per centimeter that it could pick up an image?
A. I don't have an exact number for that, but I believe it's in the range just discussed of a tenth of a degree per centimeter, maybe less.
Q. Well you said one degree per centimeter before. You said less than one degree per centimeter.
A. I believe the system that we used has a sensitivity of better than that.
Q. And how do I determine that?
A. One would determine that, for example, by generating a temperature difference and imaging it with the schlieren system.
Q. How did you determine it was point one degrees per centimeter for the system that you used?
A. Based on experience with, for example, the thermal plume from the human hand.

Q. Okay. So you're saying it's a visual test for you.
A. It's a -- This is photographed and produced as a digital image, and from the variations in the digital image one gets a measurement of the refractive index gradient.
Q. But in this case have you yourself determined what the degrees-per-centimeter ranges we're talking about for your study, for the equipment that you used?
(Interruption by the reporter.)
A. "Equipment."
Let's put it this way. In my expert report you will see the image of the plume rising from the human hand, and that is well known to produce a -- an optical refraction of on the order of an arc second, arc second. That is a very small angle. That angle then -- can then be easily converted into degrees per centimeter. And so by imaging the heat coming from the human hand we can get a reasonable approximation of a measurement for the sensitivity of the optical system.
Q. Okay. And sitting here today your best -- your opinion is that the devices that you used are able to show a point-one-degree-over-a-centimeter

gradient.
A. Yes.
Q. Okay. So just so I understand correctly, if we're looking at a one-degree change over 20 centimeters, the schlieren mirrors you used would not be able to detect that; correct?
A. There's some threshold, I'm not sure if that number is it. But if you have one degree change over a larger and larger distance eventually the effect will disappear from the schlieren visualization.
Q. Because you're looking at the refraction of light and the reflect -- the reflect might be so small as to be even captured by the camera.
A. Yeah. It's -- It falls below the noise level eventually.
Q. Okay.
A. But the more sensitive the schlieren optics is, the smaller that threshold will be.
Q. Okay. And is the sensitivity based on the camera, or the mirrors, or the whole package?
A. In the case of the instrument that we used for this study it's based on the mirrors.
Q. Okay. All right.
Do you agree that in an operating room the way a patient's draped --

And do you understand by "draping" in an operating room?
A. Yes, I do.
Q. -- the way a patient is draped will affect the airflow in the operating room.
A. No.
Q. You disagree with that. Well maybe I can change your mind.
If drapes are going around an operating room table down to the floor, do you agree with me that the area underneath the operating room table that's contained within the drapes are going to be affected by the drapes?
A. Yes.
Q. Okay. So you agree with me that the drapes can have an effect on airflow in certain parts of the operating room.
A. If you qualify the statement by saying "certain parts," then I can agree to it.
Q. Okay. With respect -- Strike that.
Did any nurses assist you with respect to your testing?
A. No.
Q. Who did the draping of the patient?
A. The members of my team, Lori -- Lori

Dreibelbis and James D. Miller.
Q. And how did they learn how to drape?
A. From the 3M draping video.
Q. Okay. So they learned how to drape by watching a video?
A. That's right.
Q. Okay. Was there anyone at 3M present during any of the testing, or the attorneys?
A. Attorney Goss and his assistant were present for part of one day of testing.
Q. What day?
A. I don't remember the -- which day it was.
Q. Did you put it in your notes that they were present?
A. Yes.
Q. You did? Okay. We'll get to that later on.
Did they assist in any way?
A. Yes.
Q. How did they assist?
A. Peter Goss got on the operating table and we took a schlieren image of him.
Q. Just laying down on the operating room table?
A. That's right, no draping or anything.
Q. Why?

A. The idea was to see the heat transfer, convective heat transfer from the human body using the schlieren imaging.
Q. Okay. Was this before or after you did your study, your testing?
A. This was early on.
Q. Okay. Was it before you created the downflow generator?
A. We had the downflow generator.
Q. And who was his assistant?
A. Charmaine Harris.
Q. Okay. And did she assist in any way?
A. You mean participate, or --
Q. Participate, assist?
A. She was involved in the discussions.
Q. Okay. Was there anything that 3M told you that you relied upon in your opinions?
A. How do you mean, "told" me?
Q. Well was there any communications that they said -- they told that you relied upon in formulating your opinions; any facts, any data?
A. They certainly provided some references, some of the references.
Q. Okay. Are those references in your report?
A. Some -- Some of the material in the report,

yes.
Q. Okay. I take it you recently reviewed your report; correct?
A. That's correct.
Q. In preparation of today's deposition?
A. Yes.
Q. Okay. And you stand by your report?
A. I stand by my report.
Q. Okay. So you've checked all the numbers in your report?
A. I've checked the numbers in the report.
Q. Have you reviewed any depositions in this case?
A. I've reviewed transcripts of three depositions.
Q. Which depositions?
A. Professor Elghobashi, Dan Koenigshofer, Professor Thomas Kuehn.
Q. Did you read --
Did you read all those depositions?
A. I did.
Q. Take any notes?
A. No.
Q. Make any highlights?
A. No.

Q. Did you make any notes or highlights in any of the articles that you reviewed or are referenced in your paper?
A. I don't make marginal notes or highlights on technical papers.
Q. Do you -- So you don't -- you --
If something is just important you take notes, like in your notebook, or you don't take any notes?
A. Well there's -- the laboratory notebook has notes, but I don't have volumes of notes, if that's what you mean.
Q. Out of all the references that you cited in your report did you read all of the articles that you referenced?
A. Yes.
Q. From beginning to end.
A. I'm not sure I read from beginning to end on every article.
Q. Okay.
A. Most of the article or pertinent parts of the article.
Q. Well how do you determine what the pertinent parts are unless you read the whole thing?
A. The articles have abstracts, they have

measurement methods, they have results and conclusions, and it's not always necessary to read all the details.
Q. So you didn't read the deposition of Al Van Duren; correct?
A. I did not.
Q. Okay. Are you aware that 3M admits that every study performed with the Bair Hugger shows an increase in particles over the surgical site?
MR. GOSS: Object to form.
MR. ASSAAD: Basis?
MR. GOSS: He wouldn't have any foundation, he hasn't read Al Van Duren's deposition. Plus, characterizing something as an admission when there are scientific studies. You can present him with the studies and ask him if he has an opinion on them.
MR. ASSAAD: What do you think a 30(b)(6) deposition is?
MR. GOSS: He said he hasn't read it.
MR. ASSAAD: Okay.
Q. Well assume that --
MR. GOSS: That's my basis.
Q. Assume that 3M admits that every study showed an increase in particles over the surgical site when the Bair Hugger was on. Assume that fact.

Have you heard of that fact before?
A. Only insofar as it appeared in a deposition transcript.
Q. Okay. So you weren't aware of that fact before; correct?
A. No.
Q. And you weren't aware that a corporate representative for 3M testified to that fact as being true.
A. I'm not aware of that.
Q. Okay. If that fact is true, does your schlieren testing support that fact?
A. Sir, you're asking me to speculate on something that I'm not aware of, that I've not studied, and I've got to restrict my comments to the work that I did that's covered in my expert report.
Q. I'm allowed to ask you hypotheticals, sir. And I'm asking you assume the fact that particles are -- are -- increase over the surgical site when the Bair Hugger is turned on. Does your schlieren studies support that fact; "yes" or "no"?
MR. GOSS: Object to form.
A. I'm sorry. Would you repeat that, please?
Q. Assuming that when the Bair Hugger is turned on that there is an increase in particles over the

surgical site, does the -- your schlieren testing support that fact?
A. I've done no such schlieren testing.
Q. Okay. And in fact schlieren testing can't determine particle flow; correct?
A. The schlieren testing determines the airflow.
Q. So it can't determine particle flow; correct?
A. It's not an appropriate instrument to measure particle flow.
Q. So the answer to my question is yes, it can't -- it can't detect particle flow; correct?
A. I'm not going to restrict it that way because I believe there's studies where particle measurements were made, but it's not an appropriate instrument. There are better instruments for that purpose than the schlieren instrument.
Q. And -- And in your study, your schlieren testing could not conduct -- could not track particle flow.
A. We made no attempt to track particle flow.
Q. And in fact it can't detect turbulence, can it?
A. Oh yes, it can.

Q. Really?
A. Really.
Q. Do you recall writing down that your testing would not be able to detect turbulence?
A. I'm sorry. We --
Q. Do you remember writing in your notes about that you won't be testing for turbulence because schlieren can't do turbulence?
A. No. Turbulence intensity.
Q. Okay. I'm sorry. Turbulence intensity. It can't determine turbulence intensity; correct?
A. In fact it can be used for that, but not in the work that we did.
Q. Okay. In the work that you did you did not detect or measure turbulence intensity; correct?
A. We did not.
Q. Okay. Have you read any of the depositions of any of the authors of the articles?
A. Well the deposition transcripts that I read were the three that I mentioned to you.
Q. What were you provided by 3M in this case, besides those three deposition transcripts?
A. I was provided expert reports.
Q. Of who? Of the plaintiffs?
A. Expert reports from the plaintiffs and from

the defendant's experts.
Q. When did you get the defendant's expert reports?
A. Recently, but I don't have exact date in mind.
Q. When you say "recently," was it --
A. Well these --
Q. -- the past week?
A. These --
As far as I know, these depositions were only held recently.
Q. I'm talking about the expert reports themselves.
A. Expert reports were due June 2nd, so it's been since June 2nd.
Q. When did you receive the expert reports?
A. Sometime between June 2nd and now.
Q. Come on doctor, you gotta give me a better time than that. You have a --
MR. GOSS: No.
Q. -- better memory than that, sir.
MR. GOSS: No.
A. Summer time.
MR. GOSS: He doesn't --
Wait for him to ask a question.

MR. ASSAAD: He doesn't have a better memory than that?
MR. GOSS: Wait. You don't --
(Interruption by the reporter.)
MR. ASSAAD: Let's not play games.
MR. GOSS: You're not going to bully him --
MR. ASSAAD: Let's not play games.
MR. GOSS: We're not playing --
(Interruption by the reporter.)
(Off the stenographic record.)
MR. ASSAAD: Let's not play games.
MR. GOSS: And I object to the suggestion that he's playing games.
MR. ASSAAD: If he cannot tell me between -- between now -- between June 2nd and July 18th an approximate time he received the defense expert reports, that's playing games.
MR. GOSS: You can make whatever comments you want. He will testify to the best of his recollection.
BY MR. ASSAAD:
Q. When did you receive --
MR. GOSS: You can answer it if you can.
Q. When did you receive the defense expert reports?

A. I would say that it's been in the month of July, but I don't have a better or particular date than that.
Q. Did you receive it this week?
A. The expert reports?
Q. Yes.
A. This is only Tuesday. I'd received it before this week.
Q. Did you receive it last week?
A. I don't have any better information than that.
Q. Did you read the expert reports?
A. I did.
Q. Which ones did you read?
A. There were four expert reports that I read, two from the plaintiff and two from the defendants: Elghobashi, Koenigshofer, Thomas Kuehn and Abraham.
Q. Did you make any notes in the reports?
A. No.
Q. Did you get Dr. Borak's report, expert report?
A. Are you asking did I receive it?
Q. Yeah.
A. I received more reports than I was able to read. I'm not sure who the others were.

Q. Did you have a list of the reports that you received?
A. I can make a list.
Q. Do you have anything with you here today?
A. No.
Q. Did defense counsel tell you not to bring anything today?
A. "Not to bring anything"?
Q. Yes.
A. No. He didn't tell me that.
Q. So why didn't you bring anything today to help refresh your memory?
A. I wasn't instructed to bring anything.
Q. Did you not receive a subpoena to have documents produced?
A. Yes, but that had nothing to do with today. I responded to the subpoena.
Q. Did you receive the expert report of Dr. Holford?
A. I don't know the --
I told you the reports that I had read. I'm not sure what other reports I received that I did not read.
Q. So sitting here today, I can go through the names of Hughes, Mont, Wentzel, Kuehn, K-U-each-A-N --

K-U-E-H-N -- Abraham, Lampotang, Hannenberg, Ho and Keen, and the only two reports that you remember receiving is from Abraham and Kuehn.
A. No. What I'm saying is the only two reports that I read were Abraham and Thomas Kuehn. I didn't read any other expert reports.
Q. Why were you --
Why did you read Abraham's report?
A. It's pertinent to the work that I did.
Q. Okay. Why was it pertinent?
A. It had especially to do with the question of velocity and temperature of airflow at the bottom of the drapes.
Q. Okay. Did you --
Do you agree with everything that Abraham put in his report?
A. Do I agree with everything?
Q. Umm-hmm.
A. That's a very broad question. I don't think I can answer that question because I would have to go back and look at everything that's in the report and I would have -- then have to decide whether I agreed with it or not.
Q. Do you agree with his boundary conditions?
A. "His boundary conditions."

Could you be more specific?
Q. Do you agree with his boundary conditions with the temperature of the air coming out of the Bair Hugger?
A. We're talking about John Abraham.
Q. Yes, John Abraham.
A. What I'm recalling is that he has a -- in his expert report, a criticism of the boundary conditions that were used in --
Q. That wasn't my question, sir.
My question was, and he knows it's not my question, that's why he's not objecting.
MR. GOSS: Yeah, but we have seven hours --
Q. My question is: Do you have any criticism of what Abraham, Abraham, Dr. Abraham, not Elghobashi, used for his temperature coming out of the Bair Hugger?
MR. GOSS: You didn't give me a chance to object. We've got seven hours, you've got all the time you need. Just let him finish his answer.
You can explain what you meant. Do you understand his question? If you do, you can answer it.
A. Well I would have to go back and look at the report in order to specifically remind myself of his

boundary conditions if I were to give you an accurate answer.
Q. So sitting here today you don't recall what Dr. Abraham put as the temperature coming out of the Bair Hugger, or the air coming out of the Bair Hugger. Is that your testimony today?
A. The air coming out of the Bair Hugger where?
Q. Around the neck and head.
A. Yes, I remember that.
Q. What was the temperature?
A. I think it was 41 degrees Centigrade.
Q. You believe it was 41 degrees?
Do you agree with that?
A. No.
Q. So you disagree with Dr. Abraham's boundary conditions.
A. In that instance I do, right.
Q. Okay. So you think Dr. Abraham is wrong in his report.
MR. GOSS: Object to form.
Q. Strike that question.
You agree with me that one of the most important boundary conditions is to determine the air coming out of the Bair Hugger for any analysis; correct?

A. Correct.
Q. And that --
And that determination of the boundary condition is going to effect the entire study if that -- if that boundary condition is wrong; correct?
A. Yes.
Q. Okay. So if he has the wrong boundary condition for the actual temperature coming out of the Bair Hugger, that would make his entire study incorrect, according to you.
MR. GOSS: Object to form.
A. I'm not going to agree to that.
Q. Why not?
A. You asked me about a component, not the entire study.
Q. Well do you agree with me that air temperature is going to have an effect on airflow?
A. The --
In other words, the temperature boundary condition --
Q. Yes.
A. -- is what you're asking me about.
Yeah, that's an important issue.
Q. I mean, you criticized Dr. Elghobashi for having the wrong boundary conditions and that's why

his report is wrong; correct?
A. I did.
Q. Okay. So Abraham has the wrong boundary conditions. Why can't you say his report is wrong? Or are you biased?
Are you biased?
MR. GOSS: Object to form.
Q. Are you being objective?
MR. GOSS: No. Now you're badgering him.
MR. ASSAAD: No.
Q. Are you being objective, sir?
MR. GOSS: No. No. No. No. No. I think the question --
MR. ASSAAD: I'm not badgering him.
MR. GOSS: Yes, you are.
MR. ASSAAD: I am not badgering him.
MR. GOSS: Well it should be --
MR. ASSAAD: You can watch the video, we can show it to the Court.
MR. GOSS: I would be happy to. In fact --
MR. ASSAAD: Yes. Let's do it.
MR. GOSS: So let's -- let's --
The question I believe was related to you criticized Elghobashi.
MR. ASSAAD: I'll rephrase the question.

BY MR. ASSAAD:
Q. You criticized Elghobashi and you said his report is wrong; correct?
A. Correct.
Q. Now you just admitted that Dr. Abraham was wrong in his exit temperature, his boundary conditions; correct?
A. Slightly wrong, yeah.
Q. Oh, now he's "slightly wrong." You change your testimony?
A. I'll change my testimony.
Q. Okay. Fair enough.
So since he's slightly wrong do you agree that you should be critical of Dr. Abraham's results?
A. Do I get to explain myself, or do I have to give you a "yes" or "no"?
Q. You can explain after you answer "yes" or "no."
A. What was your question again?
Q. Are you critical of Dr. Abraham's results?
A. Yes.
Q. Now let me ask you a question. You're a member of ASME; correct?
A. I'm a member of ASME.
Q. Do you remember the entire ethics

conversation I went through with Dr. Kuehn in my deposition of him?
A. I wouldn't say the entire, but I did read it.
Q. Okay. Are you a member of the Order of Engineer?
A. No.
Q. Do you know what the Order of the Engineer is?
A. No.
Q. Do you agree that the safety of patients is more important than your testimony?
A. Say again, please.
Q. The safety of patients in the world, you know, safety of patients is more important -- should be the ultimate concern than your testimony in this case, what your testimony should be.
A. I don't understand that question.
Q. You don't understand that question? Fair enough. I'll go to the next one, then.
Do you agree that engineers uphold and advance the integrity, honor and dignity of the engineering profession?
A. I do, but I'd like to return to the -- the first one.

Q. He can get to that later on when he asks you questions.
Do you agree --
So you agree with me that engineers should be objective, honest and have integrity in formulating their opinions.
A. I do.
Q. Okay. Do you think that engineers at 3M should be held to the same standard?
A. Say again, please?
Q. Should engineers at 3M be held to that same standard?
MR. GOSS: I'm just going to object to this whole line --
MR. ASSAAD: You can have a continuing objection.
MR. GOSS: -- as beyond the scope of his expert opinions that he will offer in this case.
Q. Do you think engineers at 3M should be held to that same standard?
A. I'm going to restrict my testimony to my expertise and my report.
Q. Sir, under the rules you cannot restrict your testimony. You gotta answer my questions unless your counsel tells you not to answer the question.

Do you agree that 3M should be held to that same standard; "yes" or "no"?
A. Engineers at 3M.
Q. Yes.
A. Yes.
Q. Do you agree that engineers must use their knowledge and skill for enhancement of human welfare?
A. Yes.
Q. Do you agree that safety is paramount with respect to engineering design?
A. Yes.
That was the first question, but I did not understand your phrasing of it. You said my testimony. It was confusing.
MR. ASSAAD: Move to strike his -- that part of the answer.
Q. Do you believe that safety of patients in -- with respect to -- Strike that.
Do you agree that the safety of people is more important than profits?
A. Of course.
Q. Engineering is a profession; isn't it, sir?
A. Yes.
Q. Not just a job, it's a profession; correct?
A. Yes.

Q. And as a professor in engineering you have a duty to teach your students regarding ethical behavior.
A. Yes.
Q. Engineers are to be honest; correct?
A. Yes.
Q. Impartial?
A. Yes.
Q. And have a --
And serve with fidelity to the public; correct?
A. Yes.
Q. And the definition of fidelity is the quality of being faithful and loyal; correct?
A. Yes.
Q. And the same applies to the engineers at 3M; correct?
MR. GOSS: Asked and answered.
A. Asked and answered, yes. I've already answered you.
MR. GOSS: It's my objection. You -- You just focus on his questions.
Q. "Yes"?
A. I believe I've already answered the question.

Q. And the answer to that question was "yes," to refresh my recollection; correct?
A. Correct.
Q. Now as someone that's going to -- Strike that.
As an engineer in this case you yourself must follow engineering ethics; correct?
A. Yes.
Q. So not just as an expert, but as an engineer; correct?
A. Yes.
Q. Okay. And to do so, to solve a problem you want as much information as possible to solve a problem when a problem presents itself to you; correct?
A. As much information as is reasonably possible, yes.
Q. Okay. Reasonably possible; correct?
So in this -- you know, in this case you want, you know, all the information regarding the Bair Hugger; correct?
MR. GOSS: Objection, vague.
Q. Like you want to have how the Bair Hugger works, how much heat it puts out, --
A. Yes.

Q. -- how much it blows; --
A. Yes.
Q. -- correct?
A. Yes.
Q. What's the flow rate; correct? The different temperature settings; correct?
Right?
A. Yes.
Q. How it's used in an operating room; correct?
A. Yes.
Q. How it's used in a hip and knee surgery; correct?
A. Yes.
Q. You want to know how patients are draped in a hip and knee surgery with the Bair Hugger; correct?
A. Yes.
Q. You want to know what lays over the Bair Hugger; correct?
A. Yes.
Q. Okay. You also want to know what studies discuss the effect of the Bair Hugger that previous scientists in the field have done with respect to the downward airflow; correct?
A. Yes.
Q. And you agree with me that as a manufacturer

such as 3M they're not going to put a product out there in the con -- with the -- in the market without doing its own internal testing; correct?
MR. GOSS: Objection, calls for speculation.
Q. Correct?
A. Would you repeat that?
Q. I mean, are you aware of any corporation that just does -- creates a product and just puts it out into the market without doing any testing on it? A medical device?
A. No, I'm not aware of it.
Q. Okay. Because that would be unethical for an engineer not to test something to make sure it's safe and reliable and okay for the market to use; correct?
MR. GOSS: Continuing objection to ethics.
Q. Correct?
A. Yes.
Q. By the way, does ethics apply to your scientific testing done in this case?
A. Yes.
Q. Okay. I mean, you don't give up being an engineer when you were retained by 3M in this case; correct?

A. I do not.
Q. Did you ever look at the design file in this case of 3M? Did they ever provide that to you, of the 775 or --
A. No, --
Q. -- any of the predecessor devices?
A. -- I do not have design files.
Q. Were you provided any testing, internal documents regarding testing of -- of the device?
A. No internal documents.
Q. Did you receive any internal documents from 3M?
A. No.
Q. Okay. You'd agree with me that it would be unethical for an engineer to ignore a potential problem than to solve it; correct?
A. Say again, please.
Q. Let me simplify it.
You agree with me that it's unethical for an engineer to ignore a potential problem that could be a risk to human welfare.
MR. GOSS: Object to form.
A. Yes.
Q. I mean, at the end, what we do as engineers, we're problem solvers; correct?

A. That's certainly a part of engineering.
Q. Are you familiar with the Ford Pinto case?
A. Only -- Well from distant memory and the transcript of the deposition of Professor Thomas Kuehn.
Q. What about the Citibank case, are you familiar with that?
A. No.
Q. Do you agree that engineers and the corporations they work for should not manipulate research?
MR. GOSS: Object to form.
A. I think you are --
You know, I'm here to testify about the work I did, and I'm not supposed to speculate.
Q. You think you would be speculating by agreeing to the statement that engineers and corporations should not manipulate research?
MR. GOSS: Same objection.
Q. You think that's speculation, sir?
A. What do you mean "manipulate"?
Q. What do you think the term "manipulate" means?
A. Change it.
Q. Okay.

A. Mess with it.
Q. Yes.
Do you think engineers should do that?
A. Can you --
Q. If you can't answer the question, you --
A. Do you mean manipulate --
Q. If you can't answer the question, you can say you can't answer the question.
MR. GOSS: Okay. But he was going to try and answer, so let him say what he was going to say.
Q. Okay. I'm just saying --
A. Do you mean manipulate for adverse effect or adverse reasons, is that what you mean?
Q. That's usually the connotation of "manipulate," yes.
A. There are other connotations, but I'll agree with that connotation.
Q. Do you agree that engineers and corporations they work for should not suppress research regarding human safety?
MR. GOSS: Object to form.
A. I agree.
Q. Now you agree with me that engineers and their corporations should warn the public of potential error -- of potential dangers of a device that's used

in the public.
A. Yes.
MR. GOSS: I'm going to object that warnings are beyond the scope of his opinions in this case.
With that objection, you can answer.
Q. So you agree?
A. Yes.
Q. Do you agree with Dr. Kuehn's teaching in his -- in his PowerPoint that nine of the most dangerous words in the English language are "if I ignore it, maybe it'll go away"?
MR. GOSS: Object to form.
A. I don't even know what you're asking me at this point.
I don't know anything about Professor Kuehn's teachings, I have not read his lectures, and I'm not going to comment on that.
Q. Have you read his deposition?
A. I read the deposition.
Q. Do you remember he said, nine of the most dangerous words in the English language are, "if I ignore it, maybe it'll go away"?
MR. GOSS: Object to form.
Q. Do you remember him saying that in his

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deposition?
A. It was a very long deposition. I don't remember that --
Q. Okay.
A. -- specific point.
Q. If you don't remember, you don't remember.
Now is everything you reviewed in this case, besi -- I mean, besides the depositions and the expert reports that we discussed, these documents that were handed to me today, which we'll mark, and what's in your references in your report?
A. Let's go through that list again, please.
Q. Okay. Maybe we'll do this. You re -- Okay.
Let's go to your report. You reviewed all the references in your report; correct?
A. Of course.
Q. Okay. And you've also brought to me today --
A. Yes.
Q. -- four, five documents --
A. Yes.
Q. -- that was given to you by counsel --
A. Yes.
Q. -- this week.
And we talked about the depositions of Kuehn

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--
MR. ASSAAD: What were they?
A. Yeah.
Q. Well the four depositions you've read; correct?
Correct?
A. Yes.
Q. Okay.
A. And also --
Q. Which was -- of Elghobashi and Dan Koenigshofer; correct?
A. Yeah. Kuehn, Elghobashi and Koenigshofer, those are the three that I read. And the expert reports.
Q. Okay. Is there any documents or research or references that you reviewed and that you're relying upon to support your opinions that are not part of the references in front of me today?
A. There were some videos that were -- that I looked up myself and that were provided to me.
Q. What videos?
A. And I only know these by -- I don't -- by particular names, because YouTube videos are kind of hard to define. But videos showing the use of the neutral buoyancy bubble technique in investigating

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operating room airflows, and videos showing laser sheet imaging of -- I believe of neutrally buoyant bubbles.
Q. And when were --
(Interruption by the reporter.)
Q. Now when were these videos provided to you?
A. Some of these videos were provided to me by 3M's counsel at the beginning of -- I would say in early April.
Q. Okay.
A. But there was a 3M video on draping, draping, and a video, basically a advertisement of the HotDog patient warmer.
Q. Are you aware of any other patient-warming systems?
A. I saw the names of some others, but I don't know anything about them.
Q. So you don't -- you've never seen the Mistral system or the Warm Air?
A. I have not seen these systems.
Q. VitaHEAT, does that sound familiar?
A. No, sir.
Q. Are you relying on those videos in any way to support your opinions in this case?
A. The ones that I mentioned.

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Q. Umm-hmm.
A. The only one of those videos that I'm relying to support -- upon to support my case would be the draping video that we used in order to understand how to drape the patient or the mannequin that we used.
Q. What mannequin did you use?
A. I don't have a specific model or manufacturer number, I'd have to look that up.
Q. Was it plastic, was it --
A. Plas --
Foam plastic.
Q. Did you see Abraham's CFD video?
A. Yes. I saw that video.
Q. Okay. Are you familiar with CFD?
A. Yes.
Q. Do you consider yourself an expert in CFD?
A. Let's put it this way. My expertise is in experimental fluid dynamics, but I have a familiarity with computational fluid dynamics.
Q. So if I asked you to do a CFD model of this room with all the bells and whistles such as what Elghobashi did, or even Abraham did, is that something you could do?
A. Now by myself I would not attempt to do a

large-scale CFD.
Q. Do you know the difference between RANS, LES and DNS?
A. Yes.
Q. Which is the better of the three?
A. "Better." Would you define what you mean by "better"?
Q. Which gives you the most realistic, real-life results?
A. In -- In what sort of a flow would you be asking?
Q. Any flow.
A. Laminar flow.
Q. Any flow; turbulent, laminar, waves in an ocean. Any flow.
Which is the most accurate with respect to the modeling and calculations?
A. Well if it's a laminar flow those methods don't apply because they're all turbulence modeling methods.
I think I can answer your question. You need to --
Q. Okay.
A. It needs to be more specific.
Q. Okay. For turbulent modeling.

A. All right. So then the order of accuracy in the case of a complex turbulent flow is RANS, Reynolds-averaged Navier-Stokes.
THE WITNESS: I can spell that if you like.
THE REPORTER: On a break.
THE WITNESS: On break.
A. That would be the least accurate for a complex turbulent flow. And the next level of accuracy would be Large-Eddy Simulation, LES. And the most accurate for complex turbulent flow, if it's feasible, would be direct numerical simulation, DNS.
Q. Do you know any of your -- any of your colleagues do DNS?
A. Yes, I know people who do DNS.
Q. Do you do DNS?
A. No, sir.
Q. Do you do LES?
A. No, I've never done LES.
Q. So you don't hold yourself out as an expert with respect to CFD for this case; correct?
A. For --
Q. This case.
A. -- this case.
No, I don't.
Q. Okay. Have you read Elghobashi's resume,

Dr. Elghobashi's resume?
A. Not in detail, no.
Q. But you've skimmed it, --
A. Yes.
Q. -- looked at --
Do you agree that he's an expert with respect to particle flow in turbulence?
A. "Particle flow."
My impression of Dr. Elghobashi is he is an expert in computational fluid dynamics.
Q. Okay. Have you heard of the Elghobashi map?
A. Only in that it came up in the deposition record.
Q. Do you know that Elghobashi's map is one of the crucial mathematical equations used for coupling with respect to particle flow that's used today?
A. I was not aware of that.
Q. Do you know the difference between single coupling and double coupling with respect to the particle flow?
A. I'm not a particle expert.
Q. Okay. Do you agree with me that Dr. Abraham is not a particle expert?
A. I can't speak to Dr. Abraham's expertise.
Q. Have you reviewed his resume?

A. No.
Q. Okay. Have you reviewed his report?
A. Yes.
Q. Do you agree that there's nothing in the report that shows particle flow, it's mostly just streamlines of air; correct?
A. I'm unsure. I know it shows streamlines. I'm not sure whether particles were involved.
Q. You agree with me that based on your experimental fluid dynamics that particles do not follow streamlines or airflow.
A. They can follow.
Q. If they're very small --
A. All right.
Q. -- and they have very little mass; correct?
A. I'll agree with that.
Q. Okay. Particles have inertia.
A. Particles have inertia.
Q. Okay. For example, if I had a 15-micron particle that's following the airstream against the wall, that particle is going to follow the wall even though the airstream might turn down, based on inertia; correct?
A. Correct.
Q. Okay.

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MR. GOSS: We've been going about 90 minutes, if we can take a break when you reach a --
MR. ASSAAD: Okay.
MR. GOSS: -- convenient spot, let us know.
BY MR. ASSAAD:
Q. You agree with me that airstreams or pathways with air do not follow turbulence, turbulence has an effect on particles as well as the airstream; correct?
A. I'm sorry.
Q. That was a bad question. I withdraw that.
Particles do not follow airstreams. You agree with that; correct?
A. They do not necessarily follow air streamlines.
Q. Based on the size of the particles.
A. That's right.
Q. Okay. Do you agree with me that turbulence also has a significant effect on particles?
A. Turbulence has an effect on particles?
Q. Yes. On the movement of particles.
A. Yes.
Q. Okay. Do you agree with me that in Dr. Abraham's report he did not take into effect the way turbulence affects particles?

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A. I'd have to go back and have a look at Dr. Abraham's report to comment on that.
Q. Okay.
MR. ASSAAD: We can take a break.
THE REPORTER: Off the record, please.
(Recess taken from 11:05 to 11:17 a.m.)
(Settles Exhibits 1 & 2 marked for identification.)
BY MR. ASSAAD:
Q. Mr. Settles, what's been marked as Exhibit 1 is your expert report that we received on June 2nd, 2017. Do you agree with that?
A. One moment, please.
Q. I think if you go to page 12 it will indicate that it has the schlieren image of the feet and the legs?
A. (Witness reviewing exhibit.) Yes.
Q. Okay. And what's been marked as Exhibit 2, also dated June 1st, 2017 is your revised report; correct?
A. Well the date's not correct on the revised report. This was more like the middle of June.
Q. I agree. I did not -- I did not alter your report. This was what was provided to us.
A. Oh, my. Yeah. I see.

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So the date on the cover was not changed.
Q. What should the date be?
A. Approximately June 18. I'm not -- I don't have an exact number.
Q. And to be fair, I will look at the file name because I believe it has the date on it. [Reviewing computer.]
Does June 15th sound more --
A. Yeah.
Q. -- appropriate?
That's what's on the name of the file, it says revised 15th June 2017?
A. That's fine.
Q. So I'll put June 15th on that.
(Discussion off the stenographic record.)
A. Should I mark it, or?
Q. No. That's fine. We'll leave it as it is. I marked it on mine.
You understand that the deadline for expert reports was June 2nd --
A. I do.
Q. -- in this case; correct?
And what made you decide to go back and check your data in the report?
A. Well it's something that I always do.

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Q. But why didn't you do that before you submitted your final report?
A. Because I finished writing it just before the deadline.
Q. Okay. You weren't given much time to do the studies, were you?
A. I -- I wouldn't phrase it that way, but I'd say we were -- we were late in the game but we had enough time.
Q. And actually you actually put it in your notes that there wasn't much time to do the studies.
A. Yeah. I made such --
Well actually that referred to, if you look to those notes, we were trying to decide what we could and could not do within the scope of the effort. And I was looking at Elghobashi's simulation and saw that he had done turbulence intensity in particle motion, and that referred to the turbulence intensity, there just wasn't any way we were going to make such measurements with the -- within the time and scope of the effort.
Q. You were retained in April in this case? April of this year?
A. Yes.
Q. Okay. And how --

Did 3M approach you or approach someone at FloViz?
A. Me.
Q. Okay. Do you know how 3M found you?
A. I'm the schlieren expert.
Q. Now you looked at the Bair Hugger blanket; correct?
A. Oh yes.
Q. Okay. Do you agree with me that there are hundreds, if not thousands of perforations in the Bair Hugger blanket that air flows out of?
A. Many perforations, yes.
Q. Do you agree with me that the majority of the air coming out of the Bair Hugger blanket probably goes over the arms and the chest as compared to the head and neck?
MR. GOSS: Objection, foundation. You can answer if you -- if you can.
A. I -- We saw air coming out around the head and neck, so there's some airflow there.
Q. That wasn't my question, sir.
A. A majority, I can't say for sure.
Q. Okay. But would you agree with me not all the air comes out of the head and neck?
A. Not all the air comes out.

Q. Do you agree that's one of the assumptions that Dr. Abraham made in his case?
A. If -- If that assumption's made I don't think it's correct.
Q. Okay. So you --
So if Dr. Abraham made that assumption, you would agree that that is not a correct assumption with respect to how the air flows out of the Bair Hugger blanket; correct?
MR. GOSS: Would you need to review his report?
Q. Just assume that that's his assumption. You agree that's a faulty assumption.
A. In my report we saw some air coming out around the head and neck.
Q. If Dr. Abraham made the assumption that all the air that the Bair Hugger generates comes out of the head and neck you agree with me that that is an incorrect assumption.
MR. GOSS: Object to form, foundation.
A. To give you an accurate answer I would have to go back and look at Dr. Abraham's report.
Q. Assume --
Would you agree with this statement: All the air that the Bair Hugger generates comes out from

the head and neck area.
A. Not based on the work that I did, no.
Q. And that's because there's holes that go along the entire length of the air -- of the blanket, correct, of the Bair Hugger?
A. The holes go the entire length of the blanket.
Q. Because it's warming the hands and the elbow and the shoulders and the chest and the other arms and hands; correct?
Correct?
A. The one we looked at, which is upper body with the arms extended, is doing what you just said.
Q. And let's assume for this -- for this -- for this day at this deposition, that when I refer to the Bair Hugger blanket I'm referring to the 522 -- --
A. Fair. Thank you.
Q. -- upper body blanket. Fair? Okay.
A. Yes.
Q. So have you ever done work for 3M before?
A. No. I gave a seminar at 3M, but that's not doing work for them.
Q. When did you do a seminar at 3M?
A. Six years ago.
Q. For what division of 3M?

A. It was the --
It was not for a division, but was for the 3M Tech Forum, which is a company-wide seminar series, as I understood.
Q. And what was your seminar pertaining to?
A. Well schlieren visualization of thermal flows and such.
Q. Do you know whether or not 3M has schlieren testing in their labs?
A. I believe they do have a schlieren optical system.
Q. Okay.
A. I saw their system.
Q. Have you read Dr. Kuehn's dep -- Kuehn's deposition where Dr. Kuehn testified that very few engineers use schlieren testing currently?
A. I did see that.
Q. Is that a correct statement?
A. No.
Q. Do you think a lot of engineers use schlieren testing?
A. Yes.
Q. Okay. If 3M performed schlieren testing on the Bair Hugger, would that information be relevant to you? On the Bair Hugger blanket 522.

A. Well, I'm speculating. I'm not aware that they performed any schlieren image.
Q. But if they did do some testing would that information be relevant to you?
A. I'd have to look at the information in order to determine relevance.
Q. And you agree with me that -- Strike that question.
Let's touch back on CFD. You criticized Elghobashi's result because of his vali -- he didn't do any validation; correct?
A. That was one criticism.
Q. And you cited an article --
Which report do you want to use for this case; Exhibit 1 or Exhibit 2?
A. Let's use Exhibit 2.
Q. Okay. By the way, did the fact that you were issued a subpoena to produce all your notes and pictures affect your edits with respect to Exhibit 2?
A. No.
Q. Okay. So were you expecting a subpoena to be received that you would have to produce your notes and pictures in this case?
A. Not exactly. I -- I was not.
Q. Okay. So if you go to the references in

Exhibit 2 --
A. All right. Page 22?
Q. Yes. I want you to turn to reference number 25.
A. Yes.
Q. Okay. It says "Verification and validation in computational fluid dynamics"; correct?
A. That is it, yes.
Q. Okay. Did you read the entire article?
A. I certainly have read it in the past. I reviewed it for -- recently.
Q. Okay. Do you subscribe to the Progress in Aerospace Sciences?
A. I'm an author of papers in that journal.
Q. Do you know Oberkampf or Trucano?
A. I know Bill Oberkampf very well. I don't know Trucano.
Q. Did you talk to him about this case?
A. No, absolutely not.
Q. Did you talk to anybody about this case except 3M and -- and your colleagues at FloViz?
A. No.
Q. Okay. What is the difference between verification and validation?
A. All right. This is a complicated subject so

I'm going to try to give you a concise answer. If a code is written there is a question in it whether the equations have been coded correct. And one of the very first things that has to happen is to verify, usually by comparing the results of that code with a known analytical solution of a flow or some experimental evidence that is beyond reproach in order to find out whether errors can be found in the code. And beyond a certain point if the code is -- does a good job of predicting these unimpeachable sources it could be said that the code itself has been verified, or free from errors. That's one step in a big process.
Q. So verification is for the code.
A. Yes.
Q. Fair enough.
A. Yes.
Q. Okay. Validation.
A. Validation. Now this is where it gets a little more complicated. There are steps beyond just the coding of the equations that are absolutely necessary in order to have a proper computational simulation. For example, a grid has to be developed for a particular problem, and if there are problems with the grid there will be problems with the

solution. So this goes beyond just the coding of the equations. And grid itself is -- it's a long issue in the literature.
Q. And meshing is very important; correct?
A. Mesh or grid is very important. It's does it converge -- does the code converge with this mesh, is the result mesh independent, and is the mesh adequately described or adequately built to get a proper solution. And this would be a mesh validation step or mesh -- mesh verification step.
And then one has the boundary conditions. And the boundary conditions have to be specified in order to get a general computational code to produce a solution for a specific problem. If the boundary conditions are not properly specified, the code will solve a different problem than the one at hand.
And so in validation steps one might test the code, the grid, and the boundary conditions to predict a flow that has been developed experimentally or been measured experimentally as a validation experiment, and therefore is available for comparison with computational results.
Is -- Am I answering your question?
Q. I got it.
So you would agree with me, you have no

issue with the verification of the code that Elghobashi used; correct?
A. I do have issue.
Q. What's the issue with the verification? Do you know what code he used?
A. Do I know what?
Q. What code he used.
A. He -- I don't know anything about the code except that he was -- it was developed at Stanford and it was run for him by a colleague who is no longer at his university.
Q. Okay.
A. But it's an LES code.
Q. Okay. And do you know whether or not that code has been verified?
A. Oh, all right. I -- I believe that there was good evidence that the code had been verified.
Q. Okay. So you have no issue with the code being verified by Elghobashi.
A. I am sorry. I have no issue with the verification --
Q. Okay.
A. -- of the code. That's right.
Q. Okay. And in fact do you know whether or not the code is --

Do you know the code that Abraham used?
A. I only know that it was a RANS code, R-A-N-S.
Q. And why do you think it was RANS?
A. Well I think that's what he said it was.
Q. Okay. Do you think RANS is appropriate to run a turbulent model in an operating room?
A. That is -- That's an oversimplifi -- oversimplification, but okay. Many, many solutions of many flows are run with Reynolds-averaged Navier-Stokes codes and reasonable solutions are obtained even though there are some pretty serious approximations in there.
Q. You agree with me that a lot of the code that's used by RANS is usually verified by LES first.
A. In my experience of u -- the verification is usually by experiment. Nowadays you can verify a simpler code like RANS by running an LES code to compare with it.
Q. And the same thing: You could verify an LES code by running a DNS code.
A. If it was possible to do so, yes.
Q. Okay. And it seems like you're very familiar with the different types of modeling. You

agree with me that DNS code has limitations, and the main limitation is computer cores.
A. Or to put it another way, that in this era it will only handle low Reynolds number flows, and you couldn't use a DNS code to compute flow over a full-scale jet liner.
Q. Because the -- the ability to compute is based on the cube of the Reynolds number; correct?
A. Yes.
Q. Okay. So you agree with me that the -- You understand that Elghobashi used LES; correct?
A. I do.
Q. You agree that the LES is more accurate than the RANS, which you've testified earlier.
A. In -- In many cases, yes. I'm not certain that LES is required for the solution of flows in an operating room, but it certainly wouldn't be a poorer solution than a RANS solution.
Q. Okay. You understand that Elghobashi testified that it was the turbulence that had a major effect -- the turbulence intensity which had an effect on the particle movement in the operating room. You understand that; correct?
A. I do.

Q. And you agree with me that LES is much more accurate with respect -- with respect to turbulence than RANS.
A. It is more accurate than RANS.
Q. Okay. And also a very important thing with LES is what you use for the sub-grid; correct?
A. Yes.
Q. Do you know what the sub-grid is?
A. Yes.
Q. Okay. Do you know what Abraham used for the sub-grid?
A. I don't.
Q. Okay.
A. But if I'm -- if Abraham used a RANS model, there is no sub-grid.
Q. Okay.
A. That's an LES term.
Q. Can you take a RANS model and just say let's do LES on it, or do you have to change the mesh? If you know. If you don't know, that's fine.
A. I believe you -- you have to change the code, --
Q. The code --
A. -- not the mesh.
Q. -- and the mesh?

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MR. GOSS: I'm just going to object that we're getting beyond the scope of his opinions. I think in his report he talks about his criticism of Elghobashi being the experimental validation and the boundary conditions.

If you know the answer, go ahead.

Q. Well let's back up a little bit.

You want to be objective; correct?

A. I do want to be objective.

Q. And if you want to -- if you're going to criticize Plaintiffs' CFD expert, you should be able to criticize defense CFD expert; correct?

A. Yes.

Q. That's being objective; correct?

(Interruption by the reporter.)

THE REPORTER: If you're going to criticize?

Q. -- Plaintiffs' CFD expert, you must criticize the defense CFD expert.

That's part of being objective; correct?

A. Yes.

Q. Part of being impartial; correct?

A. Yes.

Q. You're not sitting here being an advocate for the defense in this case.

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A. I am not.

Q. Okay. Now we've talked about you agree that Elghobashi's code has been verified; correct?

A. The code itself, yes.

Q. Okay. The validation. Now do you think that the paper written by Oberkampf and Trucano, reference number 25, states that in every single situ -- in every single complex system that validation requires actual measurements?

A. "Every single complex system."

Q. Yes.

A. I think there might be some particular complex systems that experimental measurements were not required.

MR. GOSS: The question was specific to the Oberkampf paper, number 25; right?

MR. ASSAAD: Yes.

A. But that's a detail in that paper that I would have to go back and review in order to give a definitive answer. That's a big paper.

Q. And you've read the entire thing before you cited it?

A. I have read it, yes, but I only skimmed it in preparation for this deposition.

Q. Go to page 18 of Exhibit 2. You say "there

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is no validation experiment" under number 1 of your criticism of Elghobashi; correct?

A. Yes.

Q. And then it states: "The CFD simulation of turbulent flows without any experimental validation is automatically suspect in the fluid dynamics community, and is generally not considered publishable until at least some comparative experimental data becomes available."

A. Yes.

Q. Do you believe that's cited in this paper?

A. I'm sorry. "Cited." How do you mean "cited"?

Q. Like you -- where can I find --

A. All right.

Q. -- your reliance on that in this paper?

A. Look at the --

If you look at the journals of societies like American Institute of Aeronautics and Astronautics, and the Journals of ASME I believe you will find a policy -- and let's say, also, Journal of Fluid Mechanics --

Q. Can I just stop you right there and let me interrupt? And I think Mr. Goss understands why I'm interrupting you.

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You cited the paper by Oberkampf and Trucano for that statement that, "The CFD simulation of turbulent flows without any experimental validation is automatically suspect in the fluid dynamics community, and it's generally not considered publishable until at least some comparative experimental data becomes available."

Is that in this paper that you've cited?

A. I cited the paper as a general reference on validation and verification, and I believe that that is largely correct.

Certainly in my experience over a period of years with experimental and computational fluid dynamics --

MR. GOSS: He just asked you what is in the paper. And if you know, you can answer; if you don't, then say so.

Q. You understand when you write --

You've done many research papers before; correct?

A. I have.

Q. And when you cite to something you're basically saying that this paper states what you're citing to; correct?

"Yes" or "no"? Correct?

A. Yes.
Q. Okay. So you're citing to number 25, this paper, under page 18 of Exhibit 2, to say, "The CFD simulation of turbulent flows without any experimental validation is automatically suspect in the fluid dynamics community, and is generally not considered publishable until at least some comparative experimental data becomes available."
Is that stated in that paper? Do you know, sitting here today?
A. I would have to go back and check the paper.
Q. Okay.
A. I cited that reference as the foremost reference on validation/verification of CFD.
Q. Well are you saying you're citing stuff without being sure what's in it? Is that what you're telling me today?
MR. GOSS: Objection, argumentative.
Q. I mean, Dr. Settles, by you citing it you're basically telling the scientific community that this statement is in that paper; aren't you?
A. I think that that's the general -- the gist of the paper is that, but in recent years, with the development of LES and DNS, there may be some occasions where the more advanced solutions could be

used, like DNS, for partial verification of a LES solution.
Being old school myself, I believe in experimental verification. As far as I know, there is no experimental verification for the flow in a operating room.
(Interruption by the reporter.)
Q. Do you agree with this statement: Because of the infeasibility and impractability of conducting true validation experiments on most complex systems, the recommended method is to use a building-block approach?
Do you know what a building-block approach is?
A. Step-by-step.
Q. Okay. You're a member of the AIAA; correct?
A. I am.
Q. Okay. Continue.
Do you agree with that statement?
A. Would you read the statement again, please?
Q. Because of the infeasibility and impractability of conducting true validation experience on most complex systems, the recommended method is to use a building-block approach.
A. I don't agree with that statement.

Q. Okay. So if that statement is in this paper, you would disagree with it.
A. I disagree with that statement, yes.
Q. Okay. Okay. Do you believe this statement in this paper of reference 25 is authoritative?
A. Yes.
Q. Okay. Continue on.
"This approach divides the complex engineering system of interest into three, or more, progressively simple tiers: subsystem cases, benchmark cases, and unit problems."
Do you agree with that?
A. What was the last one?
Q. "This approach divides the complex engineering system of interest into three, or more, progressively simple tiers: subsystem cases, benchmark cases, and unit problems."
Do you agree with that?
A. "Unit problems." All right.
I think I'd have to see the context on that before I could give you a -- a yes-or-no answer.
Q. You're a member --
As you said, you're a member of the AIAA; correct?
A. That's correct.

Q. And they have actually discussed verification and validation in their literature; correct?
A. That is correct.
Q. Okay. And they have an AIAA Guide; correct?
A. Yes.
Q. And actually the AIAA doesn't use the term "building-block tiers," it actually refers to them as "phases." Are you familiar with that?
A. Phases, building blocks, step-by-step, yeah.
Q. Do you understand that if a code -- Strike that.
A code could be validated by performing experimental data and testing it on more complex systems than what you are actually doing your modeling on.
A. "More complex systems."
Q. Yes.
A. In other words --
Can I rephrase this, or?
Q. Let me -- Let me --
Let me make it simpler.
A. Yeah.
Q. If I modeled this room and I had 10 air supplies and five air returns and 15 people in here

and a bunch of equipment and I modeled it and I tested it and the code was verified and validated based on the testing, that therefore if I run the same -- use the same exact code for a room this size with just one air supply, one air return, and only one person in here --

A. All right.

Q. -- that the code is -- that that -- that solution is still validated?

A. Since the code was run on a more complex system of similar type, that could be used as a validation.

Q. Okay. So the mere fact --

So you would agree with me that if Elghobashi's code, the one he used, was validated on a more complex system than what was done in this case, that in the CFD community they would consider that validated.

A. It would have to be a more complex system of the same type as the ventilation flow in an operating room, not a jet engine combustor or some such.

Q. Same physics. Ver --

According to this paper, verification is comparing physics, vali -- or, I'm sorry.

Verification is comparing mathematics,

validation is testing the physics; correct?

A. All right. The -- What I'm saying is if you want to do this with an operating room you need to find a room ventilation example that is more complicated than the operating room to be able to claim that my code works for the more complicated case, it should then work for the less complicated case.

Q. Could a clean room suffice?

A. Maybe.

Q. Okay. Isolation room?

A. Don't know about that.

Q. Okay.

A. Maybe, maybe not.

Q. But it's mainly testing the code, the math and the physics, that's the verification and validation; correct?

MR. GOSS: Object to form.

Q. According to your paper that you --

According to the paper that was cited.

A. Testing the ability of the code to predict a complex turbulent flow, which is a very difficult thing to do.

Q. So you would agree with me if Elghobashi, Dr. Elghobashi provides data that this code was

verified and validated for a more complex system with the same types of physics, airflow, turbulence, particle flow, et cetera, that you would have no criticism of the validation.

A. I'm not going to agree with that, and I can explain why.

Q. Sure.

A. That could be a part of the validation, but I still think that it overlooks the obvious step of making some measurements, it could be simple measurements, in an operating room for a direct CFD experiment comparison.

Q. Okay. So you still think you'd need measurements in an operating room; correct?

A. I'm an experimentalist.

Q. How much would it cost to make accurate measurements in an operating room, like accurate that would actually show turbulence and velocity fields and everything like that?

A. Once again, a step-by-step approach would take mean flow measurements, temperature and velocity, and then would step up to turbulence intensity measurements and so forth. But until you verified the mean flow, there's no point in using complex and expensive instruments to get turbulence intensities.

Q. You're not a particle expert; correct?

A. No.

Q. Okay.

(Interruption by the reporter.)

Q. You agree with me that reference number 25 has no discussion on whether or not a paper is publishable or not, according to what you cite it for.

A. I'm sorry. That last phrase was?

Q. "According to what you cite it for."

A. Repeat the question.

Q. You say, generally --

You say, on number 18, item number 1, that without validation in the fluid dynamics community, a paper is not publishable unless there's experimental data; correct?

A. That's the traditional view, yes.

Q. But there's no way --

I mean, I'll represent to you that I did a word search and typed in the word publish -- publishable, you know, P-U-B-L-I, and the only thing that came up was where it says 2002 published by Elsevier Science.

Do you recall even seeing that statement in reference 25?

A. Once again I cited reference 25 as a general

reference on validation and verification, but the comment also speaks to the scientific journals which -- some of which, like AIAA Journal and Journal of Fluid Mechanics, have policies that prevent the publication of pure CFD results with no comparison to experimental data or some other reasonable verification.

Q. Do you have those here today?

A. I do not.

Q. You understand that today's my day to get your opinions and your --

A. I --

Q. -- methodology and basis; correct?

A. -- understand that.

So I just gave you the sources.

MR. GOSS: Let him finish his question before you start to answer.

THE WITNESS: I'm sorry.

Q. You understand that.

A. Say again.

Q. And you understand your deadline for the expert report was June 2nd. You understand that; correct?

A. I understand that.

Q. And you had the opportunity to put those

sources in your references and cite to them in your report; correct?

A. Correct.

Q. And you fai --

And you did not do so; did you?

A. The journal.

Q. You do not cite those journals in this --

A. I did not cite those journals.

Q. -- report; correct?

A. I did not cite those journals.

Q. And you agree with me that what you cite in under number 1, reference 25, does not say that; does it, Mr. Settles?

A. I don't know. I'd have to check it.

I did cite a number of references in journals that have such a compu -- a computational policy, I believe.

Let me check my reference list.

Q. You know, I will give you this article at lunchtime, and if you could tell me where it says something's not publishable, you know, unless -- unless there's validation, I'd like you to show it to me after lunch. But I'm not going to have you go through a 50-page paper that you've said you read and know and have cited for you to find something that you

are even at this point unsure whether or not it exists in the paper. Let's move on.

Why were you given the Dasari paper?

MR. GOSS: Objection, calls for speculation.

Q. Do you know what the Dasari paper is?

A. Yes.

Q. Okay. When did you first receive the Dasari paper?

A. Recently. Last few days.

Q. Yesterday, or Sunday?

A. Perhaps yesterday. Well I --

Q. Did you say you can't remember if it was yesterday or Sunday?

A. Dasari. Yesterday, I think.

Q. Okay. How long did you meet with Mr. Goss yesterday?

A. How long?

Q. Yes.

A. I don't think I have to talk about discussions with --

MR. GOSS: You can answer.

Q. Listen, sir, let's be clear here. Unless your attorney tells you not to answer a question, your job is to answer questions here today. Do you

understand that?

A. I think I've been answering your questions, sir.

Q. Okay. So don't tell me I'm not going to answer a question unless he tells you not to answer a question.

How long did you spend with Mr. Goss preparing for today?

A. He and I had discussions yesterday, all day.

Q. Eight hours, 10 hours, 12 hours?

A. Might have been eight hours.

Q. What time'd you start?

A. Nine o'clock in the morning.

Q. And what time did you finish?

A. Probably about 10 p.m., but it was not a continuous thing. I mean, there were meals and so forth.

Q. So that's about 11 hours, minus meals and breaks.

A. Okay.

Q. Fair enough?

A. Fair enough.

Q. Okay. Did you meet with Mr. Goss since you submitted your report, or anyone from 3M since June 2nd?

A. Personal meeting?
Q. Yes.
A. No.
Q. Okay. And the first time you received this was -- the Dasari, was yesterday.
A. I think that's right.
Q. Okay.
A. Yeah.
Q. Did you discuss this article?
A. Yes.
Q. Okay. Did you read this article?
A. I scanned the article.
Q. Okay. Do you disagree with the results of the article?
A. Could I see it?
MR. ASSAAD: Let's mark this as Exhibit Number 3?
THE REPORTER: Three.
(Settles Exhibit 3 marked for identification.)
A. So your question is do I disagree with the results of this article?
Q. Yeah.
A. No. My impression of the article is that it looks at a different problem than the one at hand.

Q. Okay.
A. Because it looks at a -- a full-body warming blanket. So it's difficult for me to get -- to get any direct comparison.
Q. Okay. If there was a peer-reviewed article out there that indicated that when the upper body blanket increased the temperature above the patient, would that be relevant to your -- to your testing and study and your report?
A. I'm having difficulty answering that question the way it's phrased.
Q. Well --
A. Increase the temperature when it's -- compared to what?
Q. Let --
Compared to before the Bair Hugger was turned on.
A. Oh.
Q. Let me withdraw that question.
Based on your measurements, the temperature above the -- on top of the drape was 18 degrees Celsius; correct?
A. Well the temperature --
These are shown in the diagram. The temperature above the drape at the knee was 18 degrees

Celsius.
Q. Okay. If there was testing done that showed that the Delta -- You only see a one degree Delta there, correct, between ambient and the temperature.
A. That's right.
Q. Okay. If the testing was done that showed a four- or five-degree change in temperature when the Bair Hugger was turned on compared to when it was off, would that be relevant to your -- to your report?
A. I think it would --
MR. GOSS: I'm going to object that it calls for speculation. You can answer.
A. -- peripherally.
Q. Okay.
A. In other words, not directly relevant.
Q. Were you asked to compare the Bair Hugger to the HotDog, or was that something you came up on your own?
A. Well I think from my --
Q. It's a simple question.
Did they ask you to do it, or did you come up with it on your own?
A. I came up with that on my own.
Q. Okay. How'd you know about the HotDog?
A. Because I saw the literature on the HotDog,

the videos and the other things that we've mentioned.
Q. What do you know about Dr. Augustine?
A. Not too much.
Q. Were you provided any information about Dr. Augustine?
A. Some information.
Q. What information were you provided?
A. I believe that he originally invented the Bair Hugger, and now is aligned with the plaintiffs, who --
Q. Who told you they're aligned with the plaintiffs?
A. That's just what I've gathered.
Q. From who?
A. What I saw in case reports and this sort of thing on the internet.
Q. What in the internet indicates that Dr. Augustine's aligned with the plaintiffs in this case?
A. I don't have a specific, so I -- I should withdraw that answer.
Q. Okay. Because you have no basis --
A. I don't have a basis. I don't have who he's aligned with.
Q. Okay. I mean, this case is basically a scientific problem. You'd agree?

A. As far as I'm concerned, yes.
Q. Okay. It doesn't matter --
A. A public-safety problem.
Q. A public-safety issue; correct?
A. Yes.
Q. By the way, let me ask you a question. If during this deposition I show you something or we discuss something that may change your opinions in this case, would you let me know even though you're working for 3M, if it's going to hurt 3M?
A. If you provided me information that changed my opinions, yes.
Q. Okay. You're aware there were studies done, I see some here like the Legg studies, dealing with particle counts and bubble tests; correct?
A. Yes, I am.
Q. And all those indicated increased particles and bubbles over the surgical site; correct?
A. Increased particles and bubbles in what circumstance?
Q. When the Bair Hugger was turned on.
A. What kind of an answer are you expecting from me?
Q. You agree that those testing done by those researchers indicated that the -- based on bubble

tests and particle tests that the Bair Hugger, when it's turned on, has an effect on the airflow in an operating room.
MR. GOSS: If you need to see the paper, let him know; otherwise you can answer the question as it was asked.
MR. ASSAAD: Well if he needs to see anything he can let me know, but you don't have to coach him, Peter.
A. I'm --
What I'm getting at here is is this a yes-or-no question, or can I give you an --
MR. GOSS: You can answer, to the best of your ability, his question.
THE WITNESS: Answer to the best of my ability.
MR. GOSS: You don't have to ask him any questions.
A. And it harks back to an earlier issue, does the temperature increase when the Bair Hugger is turned on.
I believe that the temperature probably increases when any warming blanket is turned on compared to the case when it's not off. And --
Q. And --

A. -- that's not a --
Q. -- that's based on the first law of thermodynamics; correct?
A. Well first law of thermodynamics applies to all issues where heat is transferred, so you could say that.
Q. It's the conservation of energy; correct?
A. But I'm basing it more specifically on the fact that the surface of the warming blanket gets warm, there will be a thermal boundary layer on top of it, regardless of whether it's forced air or what it is, and this could then be measured and you would see an increased temperature.
Q. Okay. So if you compared --
I'll get to that later, actually.
I assume you're making the assumption that all patients must be warmed; correct?
A. Well that's the purpose of the warming blanket in my opinion.
Q. But you're not an anesthesiologist; correct?
A. Oh no.
Q. You're not an infectious disease doctor; correct?
A. No.
Q. You don't hold yourself out as an expert in

anesthesiology; correct?
A. No, sir.
Q. You don't hold yourself as an expert out in infection disease; correct?
A. No, sir.
Q. You don't hold yourself out as an expert in orthopedic surgery; correct?
A. That's correct.
Q. You don't hold yourself as an expert in internal medicine; correct?
A. Correct.
Q. You don't hold your expert --
You don't hold yourself as an expert in nursing; correct?
A. Correct.
Q. You don't hold yourself out as an expert in filter media; correct?
A. Correct.
Q. You don't hold yourself out as an expert in medical device design; correct?
A. That's correct.
Q. You don't hold yourself out as an expert in medical device warnings; correct?
A. Correct.
Q. You don't hold yourself out as an expert in

patient warming; correct?
A. Correct.
Q. You don't hold yourself out as an expert in operating room design; correct?
A. That's correct.
Q. By the way, with respect to the creation of your model or your system, did you consult with any ASHRAE 172 consultants?
MR. GOSS: 170?
MR. ASSAAD: 170. Sorry.
A. No. I didn't have -- didn't consult with people. I read ASHRAE documents that are cited.
Q. Okay. You have no experience in operating airflow; correct? Operating room airflow.
A. Clean room airflows, but not operating room.
Q. So you don't hold yourself out as an expert in -- in operating room airflow.
A. No, sir.
Q. Okay. Have you heard of ANSYS?
A. Yes.
Q. Have you ever used ANSYS?
A. Well ANSYS is the company that bought the computer -- the CFD code known as Fluent.
Is that what you're referring to?
Q. They have Fluent, they have CFX, --

A. All right.
Q. -- they have Workbench.
A. I've used Fluent in the past in teaching, and then some of my students used it in research in the past.
Q. What version of Fluent did you last use?
A. I don't --
This has been a few years, so I don't know what the version was.
Q. When you say "a few years"; five years, 10 years? Since you've last used it, not your students.
A. Well I've been refired for two years. It would have been 5 or 10 years, yeah.
Q. Okay. Do you know what Boussinesq is, approximation?
A. The Boussinesq approximation, yes.
Q. What is it?
A. That's an approximation used in computational fluid dynamics in which density effects are ignored if the force of gravity is not explicitly involved.
Q. Is density effects ignored for all the -- the variables in the equation, or just for certain ones?
A. The ones that are coupled with the force of

gravity.
Q. Have you ever used the Boussinesq approximation?
A. I've never written a code that involved the Boussinesq approximation.
Q. Have you ever used it in an ANSYS Fluent?
A. I've not used very much ANSYS Fluent --
Q. Okay.
A. -- personally.
Q. Do you even know if ANSYS uses the -- ANSYS Fluent uses the Boussinesq approximation?
A. No, I don't.
Q. Okay. Do you know when it's appropriate to use the Boussinesq approximation?
A. It has to do with particle motion in the air.
(Interruption by the reporter.)
Q. Does it work with a complex system that has -- Strike that.
It assumes density is constant; correct?
A. It ignores some density effects if the gravitational force is not involved. That's my understanding of the Boussinesq approximation.
Q. And density is related -- and air are related to temperature; correct?

A. It's inversely related to temperature at constant pressure, that's right.
Q. Okay. And if there's a significant difference in temperature, you would agree with me that using the Boussinesq approximation might cause error.
MR. GOSS: I'm just going to object that this is beyond the scope of his opinions.
You can answer if you know.
A. I know that Boussinesq can fail under certain circumstances. I also know that it's an important approximation in computational fluid dynamics within its realm of application.
Q. Would you agree with me that based on the literature and ANSYS guidelines that ANSYS is supposed to be used for natural convection cases?
A. Is -- ANSYS --
Q. Natural --
For natural convection.
A. -- is a --
Q. Supposed to be used for --
A. "Supposed to be used."
Q. I'm sorry. "Can be used."
A. "Can be used." "Can be used."
Yes, it certainly can be used for natural

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convection.
Q. And you would agree with me that -- Strike that.
Do you know whether or not ANSYS Fluent or CFX has been verified?
A. The code itself has been around for a long time, so I think that code verification has long since been done.
Q. What about validated?
A. Well that --
Validation speaks to particular problems with particular grids and particular boundary conditions.
Q. And you agree with me that since ANSYS is a commercial product that they don't make any representations of validation because their product is used for so many different types of modeling.
A. I don't really know what representations they make.
Q. Okay. You agree with me, though, that to use the Boussinesq approximation in ANSYS that that would have to be validated for a system that's more complex than an operating room; correct?
A. Oh wow.
MR. GOSS: Again it's --

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A. That's --
MR. GOSS: well --
A. I don't really know how to answer that question.
Q. Okay. Well you testified earlier that a code could be validated if, for example, you're doing an operating room or a clean room or something similar and it was validated for a more complex model than what you're actually doing at this --
A. That could be one form of validation.
Q. Okay. So to -- if you --
Like, for example, if the Boussinesq approximation was not validated for a model that's more complex, say for -- in this case for an operating room --
A. That's not validated.
MR. GOSS: Wait. Wait. Let him finish his question before you start to answer, please.
THE WITNESS: Sorry.
Q. -- was not validated, then without experimental testing you cannot validate your results; correct?
A. If the Boussinesq approximation was not validated, then without experimental vali --
Q. Validation, you could --

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A. -- validation, you could --
Q. Experimental data, --
A. Data.
Q. -- you could not validate your results.
A. That --
That's a little too contorted for me to --
Q. Okay.
A. -- get a clear idea of what it is you're asking.
Q. We'll move on, then.
Have you received --
Are you familiar with Dr. Sessler?
A. Vaguely, yeah.
Q. Have you not reviewed his study on parti -- that 3M funded on particle counts?
A. I'm not particularly concerned about --
Oh, wait a minute. "Particle counts."
Q. Yeah.
A. I'm not familiar with Sessler's study on particle counts.
Q. Well, are you surprised that 3M actually funded and conducted a study on the effect of Bair Hugger in an operating room using particle counts and that they have not provided you with either the paper or the underlying data?

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A. Well, no. I did my own literature search. So if this was relevant, I should have found it myself.
Q. Well it's -- it's a paper funded by 3M that compares the Bair Hugger -- that looks at the Bair Hugger's effect on the laminar flow in -- in two test sites in Holland that was done in 2010 and published in 2011.
And I take it you didn't -- you didn't find that article.
A. I didn't.
Q. Okay. Do you believe that if you are -- have been retained by a company such as 3M, that they would supply you with relevant data to your research?
A. I didn't expect 3M to provide me with the data. As a scientist it was up to my -- to me myself to learn what the literature had to say.
Q. So the fact that you didn't find the Dr. Sessler article, would you agree with me that your research was not complete?
A. Well --
MR. GOSS: Object to form.
A. -- one does a literature search, one never finds all the pertinent references. But I'll certainly go look for that one and read it.

Q. Did you ever go to the 3M website or the Blackwell Burke website on forced-air warming?
A. No, sir. I did my literature research using the traditional search engines that are available.
Q. What'd you use, Google?
A. Google Scholar, and ISI's Science Citation Index, which includes PubMed.
Q. Okay. And what were the search terms you used?
A. Search terms were, oh, hospital, infection, surgery, operating room, CFD. I also included the search term "schlieren" to see if anyone -- see if I could find any previous work using schlieren optics, which I did not.
Q. You did not use the word "Bair Hugger"?
A. Patient-warming blanket, but I did not use product names, no.
Q. So 3M retains you.
Are you aware that 3M actually has a compendium with every single article written on Bair Hugger in a nice thing you could download?
A. Not aware of it.
Q. They didn't tell you that?
A. Not aware of it.
Q. So 3M did not tell you that.

A. I think I answered the question.
Q. Okay. Well you said you're not aware of it, so I'm going to assume that --
A. No one told me that.
Q. Okay. Well do you know why not?
MR. GOSS: Calls for speculation.
A. I think I already explained that I didn't depend on 3M for literature.
Q. Well we got Exhibit 3 they gave you; correct?
A. Well I certainly looked at literature that was provided.
Q. Are you relying on -- on --
MR. ASSAAD: Let's mark this as Exhibit 4, this as Exhibit 5, and this as Exhibit 6.
(Discussion off the stenographic record.)
(Settles Exhibits 4 - 6 marked for identification.)
BY MR. ASSAAD:
Q. Are you relying in any of your opinions on Exhibits 4 through 6?
A. (Witness reviewing exhibits.) All right. Yes.
Q. You are?
A. I -- Here's the issue. I was aware of 4 --

sorry -- 5 and 6.
Q. Are those the Legg articles?
A. The Legg articles.
Q. Okay.
A. And I considered them to be part of a series of articles that culminated in the McGovern article, which I cited and therefore relied on, which spoke to, among other things, the use of neutral buoyancy helium bubbles in investigating patient-warming blankets. Okay?
So does that answer the question as far as those two?
Q. Kind of.
What about the Oguz article?
A. This one I only saw yesterday, so I can't really -- it's an interesting article, but certainly it came after my opinions were formed.
Q. I thought it came out in January or something.
A. I certainly wasn't aware of it if it came out in --
Q. So --
A. -- January.
Q. -- besides the how-to-drape video, what else did 3M give you before you formulated your opinions in

your report?
And I'm talking about documents, I'm not talking about depositions or reports --
A. Yeah.
Q. -- just documents.
MR. GOSS: Or equipment.
Q. Or equipment.
A. I'm looking at my reference list.
Most of these references came from my own search.
Q. Well just tell me the numbers that 3M gave you.
A. 16.
Q. Okay.
A. 19.
Q. Okay.
A. And 23.
Q. Okay. And I'm sure they gave you 26 and 27; correct?
A. Yes. That's right.
Q. Well, I'm sorry, 26.
Did they give you 27, the computa -- the YouTube video?
A. They pointed me to that video, yes.
Q. Was that in an email?

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A. I don't remember how it was --
Q. Were there any emails between you and your colleagues regarding the testing?
A. You mean my colleagues in FloViz, Incorporated.
Q. Yes.
A. If there were emails they were scheduling emails, you know, we're going to -- let's test tomorrow at such-and-such a time, not technical emails.
We sat down and discussed issues that we were going to test and how we would do it, and it was not passed generally by emails.
Q. Did any of them take notes, have a notebook such as yourself?
A. The notebook that you have is the -- "the" experimental notebook. Nobody else had an experimental notebook.
Some of my colleagues wrote in the notebook when they did -- took measurements.
Q. Okay.
A. But we wanted to keep that all in one notebook.
Q. The Bair Hugger that was provided to you, was it brand new or used?

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A. Brand new.
Q. Okay. Was it calibrated?
A. I actually don't know what that means in ter -- in reference to the Bair Hugger.
Q. Did you check the filter in it?
A. And now you're talking about the blower unit.
Q. Yes.
A. Sorry.
I need to distinguish between the blower unit --
Q. Okay.
A. -- and the blanket.
Q. Let's talk about the blower. Did you test it?
A. The blower unit that they gave us was -- I believe it was brand new, we did not check the filter unit.
Was there another question?
Q. No.
A. All right.
Q. So you don't know if it was properly calibrated or tested; correct?
A. I assumed that it was.
Q. Did you test the temperature coming out of

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the hose?
A. I don't believe it's in my report, and therefore I don't think we actually measured the temperature coming out of the hose.
Q. So sitting here today, the temperature coming out of the hose could have been 40 degrees instead of 43; correct?
A. Well it was 43 set on the blower unit.
Q. I understand that.
A. But if --
We didn't measure the temperature coming out of the hose, so we don't know what that is.
Q. The 43 degrees, what's that temperature indicate to you; the temperature coming out of the end of the hose, or the temperature coming out of the -- out of the blower?
A. That's the setting of the blower unit.
Q. Okay. So it's the setting of the blower unit.
A. Yeah.
Q. Okay.
A. The temperature coming out of the hose would be lower than that.
Q. It would decrease because it would lose energy down the --

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A. The transfer of the hose.
Q. -- the two- or three-step hose. Okay.
MR. GOSS: Make sure to let him finish his question before you start to answer, otherwise it's going to be very, very difficult for our court reporter.
Q. So you agree with me that the temperature would decrease from the en -- from the end where the unit is to the end of the hose due to heat transfer into the environment through the hose.
A. Some decrease. I'm not sure how much.
Q. Greater than one degree?
A. I'm not sure how much.
Q. Okay. Did you check the volumetric flow coming out of the hose?
A. I didn't have a way to measure volumetric flow, so no.
Q. Okay. So you just assumed that 3M gave you a properly working device; correct?
A. Yes.
Q. Okay.
A. It was a brand new device.
Q. Have you ever heard of a manufacturing defect?
A. Of course.

Q. Okay. So wouldn't it be --
I mean, you tested your schlieren devices before you used it; correct?
A. In the sense of manufacturing defects, no.
Q. No, but you test it to make sure, you tested it with a hand and the candle.
A. Okay. Yes.
Q. Okay. You made the sure the camera was working properly; correct?
A. Yes.
Q. You made sure that the mirrors were adjusted properly; --
A. Yes.
Q. -- correct?
A. That's right.
Q. That's very important before you do a scientific test; correct?
A. Yes.
Q. Okay. But you did not do that in this case, did you, for the Bair Hugger blower.
A. No.
Q. Okay. And do you have any experience with 3M to indicate that they are an honest company and are honest to the public?
MR. GOSS: Objection to form, beyond the

scope of his opinions.
A. I have no reason to believe that 3M is dishonest.
Q. So you never heard of any claims of 3M, you know, dumping chemicals in Minneapolis, there was a huge cleanup and lawsuit?
MR. GOSS: Objection, lack of foundation.
MR. ASSAAD: Is that not true?
MR. GOSS: I think he's entitled to see whatever evidence you want to put in front of him.
MR. ASSAAD: I'm asking if he's aware of it. I'm trying to get evidence.
A. I'm not aware of dumping chemicals.
Q. Sitting here today you have no basis to determine the credibility of 3M or its attorneys with respect to whether or not they gave you a properly functioning Bair Hugger unit; correct?
MR. GOSS: Objection to form, calls for speculation.
A. Could you repeat the question?
Q. I'll withdraw the question if you can't answer it.
MR. GOSS: I'll just object to the commentary --
Q. Have you been provided --

MR. ASSAAD: I'm sorry. You done?
MR. GOSS: I'm done.
Q. Have you been provided with any of the punitive damages motions against 3M or responded by 3M?
A. No.
Q. Okay. Have you been provided any of the schematics of the Bair Hugger?
A. Schematics came, and instructional or user's manual type material came with the Bair Hugger blower and the blanket. Those were all the documents we had on it.
Q. Have you --
Did you do any mathematical calculations as to what you would believe, from a theoretical standpoint, not experimental, of what the effect the Bair Hugger would have on the unidirectional flow?
A. My study was an experimental study and not a computational study, so no such calculation was made.
Q. Okay. Do you know how many BTUs per hour the Bair Hugger puts out when it's on high?
A. I don't have a number in memory, no.
Q. Did you ever see a number?
A. Yes.
Q. Where?

A. It's in the literature in the na -- faceplate on the device.
Q. Okay. Are you aware of any device in the operating room that puts out more BTUs per hour than the Bair Hugger?
A. Well I'm aware that there are various heat loads in the operating room. There's electronic equipment and other things. I don't think I should speculate on what puts out more and what puts out less.
Q. Well you agree with me that the Bair Hugger puts out more BTUs per hour than an individual.
A. Than a human.
Q. Yeah.
A. Yeah. I think that's --
Q. You agree with that?
A. I think that's reasonable.
Q. It puts out more BTUs per hour than a computer monitor.
A. I don't know how many BTUs per hour -- right now I don't have a number for the Bair Hugger or the computer monitor or other equipment.
Q. So you didn't look at that at all; correct?
A. That's not really an issue in --
Q. In what you --

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A. -- what was done in my study.
Q. Okay. It wasn't relevant to your study.
A. No.
Q. Okay. Did you look at the Moretti study? Does that sound familiar?
A. No.
Q. Did you look it the Huang study?
A. No.
Q. Did you look at --
You cited to a study by Farhad Memarzadeh.
A. Yes.
Q. Do you know him personally?
A. No, I don't.
Q. Are you aware that he did a study that indicated that the older model, the 505 model, disrupted the unidirectional airflow in the operating room?
MR. GOSS: Object to form.
A. The 505 model of what?
Q. The Bair Hugger.
Do you know what the 505 model is?
A. No.
Q. Okay. So sitting here today your report only applies to the 775 and not the 505; correct?
A. Correct.

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Q. Okay. So in a case in which the 505 was used, your report has no relevance or reliability to it; correct?
MR. GOSS: Objection to form, report speaks for itself.
A. I don't know anything about the 505.
Q. And that's my point.
So your report, since it has nothing to do with the -- has no data on the 505 or no studies on the 505, does not apply to the Bair Hugger 505 device; correct?
MR. GOSS: Same objection.
A. I would have to have a look at the 505 before I could give you a competent answer.
Q. Well since your entire basis of your opinions is on experimental data, wouldn't you need the 505 to do experimental data to see how it affects the operating room?
A. I don't even know what the 505 is.
Q. Okay. So sitting here today, your -- since you don't know what the 505 is, you can't say that your report applies to the 505; correct?
MR. GOSS: Same objection, the report speaks for itself.
A. Correct.

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MR. ASSAAD: By the way, the report's not admissible in evidence and that's why I get opinions from him.
BY MR. ASSAAD:
Q. And you're not going to offer any opinions with respect to the air quality coming out of the Bair Hugger blower or blanket; correct? As to whether or not it's contaminated or not.
A. No.
Q. Okay. Are you aware that the Bair Hugger -- the previous models -- a few of the previous models of the Bair Hugger before the 775 warned of airborne contamination when in use?
A. No.
Q. Would that affect your opinions in this case?
A. My opinions are based on the Bair Hugger 522 model and 575 power source that we used.
Q. 775 power source.
A. 775. I'm not in a position to state an opinion on earlier models or...
Q. I understand that, Mr. Settles, but you have to sit here and agree with me that you do not have all the information with respect to the studies or the internal documents that are available when you

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prepared your expert report; correct?
A. We certainly didn't have information on previous models of Bair Hugger, no.
Q. And you do not have all the studies; correct?
A. No.
MR. GOSS: Objection to form.
MR. ASSAAD: Basis?
MR. GOSS: He said he did a literature research -- a literature search.
MR. ASSAAD: And he admitted he didn't have --
MR. GOSS: I'm not sure --
MR. ASSAAD: Sorry. Go ahead.
MR. GOSS: I'm not sure that you've established everything that he reviewed.
MR. ASSAAD: Well we admitted that he didn't have the Dr. Sessler study, so he definitely didn't have all the studies.
Q. So you agree with that statement; correct? You didn't have all the studies.
A. That's right.
Q. Okay. You didn't have --
You didn't have some of those studies, correct, that were provided to you yesterday before

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you'd written your report; correct?
A. Correct.
Q. Okay. You didn't have any of the warnings that were provided to previous models; correct?
A. I'm not sure what warnings you're referring to.
Q. About airborne contamination.
A. No, I did not have.
Q. You were not provided internal data that 3M did with respect to the airflow of their models; correct?
A. No. No internal data, no.
Q. You weren't provided the Sessler study, which was funded by 3M and paid for by 3M to -- regarding the specific issues in this case.
MR. GOSS: Object to form.
A. I was not provided the Sessler report.
Q. Okay. Were you provided the 5 --
Do you know what a 510(k) is?
A. No.
Q. Okay. Were you aware that other scientists in the field, specifically scientists on the 3M Advisory Board, recommended doing further research with respect to whether or not the Bair Hugger disrupts airflow in an operating room?

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MR. GOSS: Object to form, calls for speculation.
Q. Were you aware of that?
A. No.
MR. GOSS: I could use another bathroom break if you reach a point where that would make sense.
Q. Do you --
Would you agree with me that 3M should be the most knowledgeable about the devices they manufacture?
A. Yes.
Q. And therefore they'd be aware of all the studies and all the research with respect to a certain -- with respect to the Bair Hugger?
A. I really can't say what they're aware of.
Q. Well they would be the most knowledgeable about what's out there regarding the products they sell; correct?
A. I'm assuming that a manufacturer of a product would be very knowledgeable about their product.
Q. And they could have given you a lot more information than it seems like they did in this case; correct?

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MR. GOSS: Object to form.
A. And I've already answered that my scientific approach is it's up to me to go find the literature. If I didn't have the Sessler report and some other literature I consider it that it was a flaw in my literature search. I wasn't depending on 3M or their legal team to provide me with the sets of references.
Q. Well why recreate the wheel? I mean, if there's other studies, don't you want to build on previous studies?
A. That's what a literature search is about, to educate myself.
Q. Okay.
A. But a -- a scientist and an engineer, in order to remain objective, better to educate himself than to go looking for material that's already been prepared by someone else.
Q. I agree.
But if 3M has internal documents or there is peer-reviewed literature that contradicts your findings, wouldn't that have an effect on your methodology with respect to what you did in this case?
A. Well --
MR. GOSS: Objection, contrary to fact, calls for speculation.

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A. I'm not aware of such literature.
Q. So if there's literature out there that indicates that particles increase over the surgical site, okay, and that the heat is significantly increased over the surgical site, which is contrary to what you're finding, okay, that would have no effect on your -- your -- the results of your tests --
MR. GOSS: Object to form, --
Q. -- and your confidence --
MR. GOSS: -- lack of foundation.
Q. -- in the results?
MR. GOSS: Object to form, lack of foundation, calls for speculation.
A. The way that's phrased I'm not even sure if you're talking about particles that come through the hose of a -- the Bair Hugger blanket or are somehow brought from somewhere else.
Particle contamination through the hose that you've mentioned is -- I realize it's a concern, but it's not within the scope of the work that we did.
Q. I understand that.
But that would be something for you to determine, whether or not their particles are increased because of what's coming out of the hose or because of convection currents; correct? I mean, that

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would be part of your research -- your research on this issue; correct?
MR. GOSS: Object to form.
A. That --
When you say "that," what are you referring to?
Q. Like -- Let me rephrase.
As a scientist, before you do any type of research you want to learn as much as possible about what other people did in the commun -- in the scientific community; correct?
A. Within --
Q. "Yes" or "no"?
A. Within the limits --
I can't give you a yes-or-no answer to that question.
Q. Okay. Within the limits of what?
A. Within the limits of the scope of what I'm trying to do. But I was not trying to cover all possible aspects of particles and so forth. I was -- I have a limited scope to try to do schlieren imaging and try to get a picture of the airflow situation that's going -- that's happening.
Q. And you also did temperature measurements; correct?

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A. I did some ancillary temperature measurements. These were secondary, but they're -- they're in there.
Q. By the way, what did you use for the temperature measurements?
A. It's indicated in the report, it's a TSI Model 9515 Air Velocity Meter.
Q. Okay.
A. Also measures temperature.
Q. I thought you told me before you couldn't measure velocity.
A. I told you I couldn't measure mass flow rate.
Q. Okay.
A. I can infer mass flow rate by measuring the velocity across a surface.
Q. Okay. And is that TSI temperature velocity meter, is that that you guys own, or was -- did you guys rent it?
A. We bought it brand new.
Q. From this -- For this --
A. From TSI, a reputable Minnesota company.
Q. Okay. Was it calibrated?
A. It was calibrated, and it came with its calibration.

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Q. Did you not attach the calibration sheet to the report?
A. I did not.
Q. Okay.
THE WITNESS: There's been a request for a break?
MR. ASSAAD: Okay. We can take a break.
THE REPORTER: Off the record, please.
(Recess taken from 12:36 to 12:47 p.m.)
BY MR. ASSAAD:
Q. Going back to Exhibit 2, page 18, your Critique of Expert Report by Said Elghobashi, number 1). You'll agree with me that verification and validation that we were discussing is specific to the CFD community; correct?
A. It's a CFD concept.
Q. Okay. Okay. And you yourself don't hold yourself out as an expert with respect to CFD; correct?
A. That's correct.
Q. Okay. Let's talk about methodology, all right?
And I want to be specific to your methodology in your testing in this case.
A. Okay.

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Q. So I know you didn't create a protocol, but let's just go through it so I understand that if I want to -- Just so I can understand what you did. Fair enough?
A. Well, as we discussed, I created a test plan.
Q. Okay.
A. "Protocol," I am not sure that that's the same thing, but.
Q. Your test plan would be considered your methodology; correct?
A. That's right.
Q. Okay. And so the first thing was is to set up the -- the model, I would say; correct?
Correct?
A. Correct.
Q. And it's my understanding you used a warehouse; correct?
A. It's in a warehouse building.
Q. Okay. Is that the warehouse building that FloViz is located?
A. It's a --
Yeah. It's a steel warehouse building.
Q. Is that where -- Is that --
What's the address of that building?

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A. 76 Sky Harbor Drive, Port Matilda, PA.
Q. Is that the same address where FloViz is?
A. That's the address of the company.
Q. Is it -- Is it --
Did you rent that warehouse for this project?
A. No. It's on the property. It's owned by the president of the company.
Q. Okay. And the room in which you did the testing, how big was that room?
A. Approximately fifty -- 50 feet long, and the space available was 25 feet wide.
Q. So it's 50 by 25; correct?
A. Umm-hmm. Correct.
Q. How tall; how high is the ceiling?
A. It's a peaked roof, and I would say that's 20 -- 20 to 25 feet.
Q. Twenty to twenty-five feet?
A. Yes.
Q. And when you say it was peaked, was the -- the setup of the operating room table underneath the center?
A. Yes.
Q. Okay. So it's at the peak.
A. It's underneath the peak.

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Q. Underneath the peak; correct?
A. Yes.
Q. Okay. And you had a flow generator; correct?
A. We built one.
Q. Okay. And how was that placed up high?
A. It's suspended by cables and could be, to -- within a certain margin, raised or lowered -- actually I don't think it was -- we had much margin. So it was -- I -- Sorry.
Do you have a question?
Q. Yes. So it was suspended from the ceiling.
A. Suspended from the ceiling.
Q. Okay. And my understanding is the dimensions of that was 4 by 5 feet; correct?
A. Correct.
Q. And that was powered by an eight horsepower motor; correct?
A. Eight horsepower blower.
Q. Okay.
A. In other words, it had an eight horsepower motor.
Q. Okay. And you had a throttle on that to control the volume of air; correct?
A. Correct.

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Q. Okay. And inside the flow generator you had a -- a flow distributor; correct?
A. Yes.
Q. And what was that constructed of?
A. On Figure 3 you'll see it diagramed. It has a -- It's constructed of a filter material, furnace filter material.
Q. Okay. And then you had an aluminum honeycomb?
A. That's right.
Q. What was the purpose of the aluminum honeycomb?
A. It's a flow straightener. And it also supports the furnace-filter interior.
Q. Okay. Do you know what the filtration level of the filter was?
A. I don't. The filter material was used only to create a pressure drop, it has no -- nothing to do with filtering particles.
Q. Okay. And at any time during the experiments or the testing did you change the height of the flow generator?
A. I believe the height of the flow generator was fixed.
Q. Okay. All right. And then you had a -- a

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simulation of an operating room table; correct?
A. That's right.
Q. What was that constructed of?
A. Plywood.
Q. Plywood. And explain it to me how it was constructed.
A. Do you mean its design, or?
Q. What are the dimensions?
A. All right. Well I don't have my logbook in front of me, but we -- it was modeled upon a surgical table. We looked at actually buying a surgical table, and these are very expensive and -- and it takes time to get it shipped, so the simpler solution was to build a mock-up.
MR. ASSAAD: I want to apologize because for some reason I don't have three copies of the logbook. But I have one, and I can use mine online. So let's mark this as Exhibit Number 7?
THE REPORTER: Correct.
(Settles Exhibit 7 marked for identification.)
BY MR. ASSAAD:
Q. What's been marked as Exhibit 7 is a logbook, a redacted logbook that was redacted by, I guess the attorneys in this case, that's been provided

to me.
Is that the logbook you're referring to?
A. Correct.
Q. Okay. Now --
A. If you will --
Q. Before I get to the question, I just want --
A. I'm sorry.
Q. What has been redacted, to your knowledge, with respect to the first three pages or four pages?
MR. GOSS: Hold on. I will state for the record that what has been redacted is notes of conversations with counsel and items that counsel for 3M deemed to be attorney work product.
Q. Is anything that's been redacted any of the facts that you're relying upon that you used to create your testing method?
A. I don't think so, no.
Q. Okay. So let's go to the operating room table.
A. All right.
Q. So what did you look at to create your operating room table?
A. Top left of page 7, and it's a brief sketch.
Q. Wait. Hold on one second. Top page of... Okay.

A. The table --
This was built of plywood, it was -- we were able to raise it and lower it. The typical height was 48 inches, the table was 20 inches wide, and I believe it was six feet long.
Q. Okay.
A. And it stood on a pedestal similar, in general, to the kind of pedestals that you will find on actual operating room tables.
Q. Was it a wood pedestal or metal?
A. Wood pedestal.
Q. And you said it was adjustable?
A. The entire device could be built up on -- on blocks to be raised above floor level.
Q. Raiser blocks; correct?
A. Yes.
Q. Okay. Now throughout the entire experiment did you ever change the height?
A. We did.
Q. To what?
A. In the --
Well this refers to the material that was in Exhibit 1. But it was necessary to raise the height so that -- because the 30-inch circle of the schlieren mirror is not movable. So if you want to look

underneath the surgical table you have to raise the table, --
Q. When you --
A. -- and in this case --
Q. Go ahead. I'm sorry.
A. In this case, and I'm going to -- I don't exactly know the number of the feet that it was raised. Wait a minute.
Q. Are we talking about on page 12 with respect to the -- the schlieren view of the feet? [Exhibit 1.]
A. That's right. Page 12, Figure 11 a. So the floor level effectively was raised up to the mirror height around 48 inches.
Q. So you raised up the floor by 48 inches.
A. Or -- Or some value approaching it.
Q. Is that anywhere in your notes?
A. Exactly what the number was?
Q. Yeah.
A. I don't think so.
Q. Don't you think that would have been helpful to determine the height of the table?
A. Well actually I could get that easy enough -- easily enough because I know the height of the circle, and there's the floor [indicating].
So although I don't have it in hand at the

moment, it's easy enough to determine.
Q. So when you changed --
Now you mentioned before you never changed the height of the flow generator; correct?
A. That is correct.
Q. So you raised the table, you didn't change the height of the flow generator; that's correct?
A. As I recall now, it was not possible to -- well it was not possible to raise the -- the downflow generator higher because of rafters in the building. To lower it didn't make any sense, it was already at its correct position.
Q. And therefore when you raised the height of the operating room table you did not raise the height of the --
A. No. That wasn't --
Q. -- flow generator.
A. -- that wasn't possible.
Q. So I'm correct.
A. You are correct.
Q. Okay. So therefore the distance between the top of the operating room table and the flow generator decreased by three to four feet.
A. Some distance roughly in that order.
Q. Well the distance you have here is five

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feet, according to your diagram, between the bottom of the flow generator and the top of the table; correct?
A. Five feet.
Q. Okay.
A. Yeah.
Q. So would it be fair to say that when you raised the table by three to four feet, you significantly decreased the distance between the flow generator and the top of the table?
A. It would be. But let me point out that the only case in which that was done ended up being removed anyhow for another reason.
Q. And you -- the reason why you removed it is because the testing for that part was not reliable.
A. Because there was a discrepancy between my recollection of the test conditions and what was entered in the logbook.
Q. And since there's a discrepancy that means the results are not reliable; correct?
A. In that particular case I considered the results questionable, and therefore I removed them.
Q. And "questionable" is synonymous for "not reliable"; correct?
A. Yes.
Q. Okay. Okay. So the plywood you said was,

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I'm sorry, six feet by 20 inches?
A. It's shown to be 20 inches, and in the diagram and my recollection of the length was six feet.
Q. Okay. What did you use to compare your operating room table, did you have a sample operating room table that you looked at?
A. I believe that we looked at material online and images and information on operating tables to try to get an impression of what was the usual case.
Q. Okay. Now why did you pick 48 inches of a height?
A. I would have to go back and check. It may be that the 48-inch dimension that's shown in this diagram at the top of page 7 of Exhibit 7 is with the table on top of concrete blocks so the distance from the floor to the tabletop is less than 48. And this is -- this is a number that I could determine and provide, but I don't have it with me at the moment.
We tried to get the table at the regulation height, or something like the height of a surgical table, and that may be the distance in this diagram from the top to the wooden floorboard, but that already sits on top of concrete blocks that are several inches high.

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Q. You agree with me that -- Well, strike that.
So sitting here today you don't know the answer to that question; correct?
A. I would have to look that up.
Q. Where would you have to look it up?
A. I'd go look at the actual table.
Q. So that still exists.
A. Oh yes.
Q. Okay. The setup still exists.
A. Well it's not set up for experiments now, but the equipment still exists.
Q. Can the schlieren mirror move up and down?
A. Oh no.
Q. It's in one position?
A. It's a very heavy device and we have no mechanism for translating it, and if we did this would require total realignment of the optics, so it -- that was the fixed position --
Q. Okay.
A. -- of the experiment.
Q. Okay. Now you agree with me that the distance between the flow generator and the top of the operating room table is relevant to the results.
A. I don't think it's very relevant. This is a uniform downflow, and so changes in height are

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secondary importance.
Q. Okay. So you believe --
It's your expert opinion today that the flow coming out of the flow generator is uniform.
A. Well, within a tolerance, yes.
Q. What's the tolerance?
A. Plus or minus 30 percent.
Q. Thirty percent.
A. Yes.
Q. Okay. And that's not what you put in Exhibit 1; correct?
A. What I put in Exhibit 1 unfortunately was more of a goal than a final result, and that's why it had to be corrected.
Q. Well are we doing goals here or are we doing testing results?
A. Let me clarify what I just said. In Exhibit --
Where's Exhibit 1?
So when I wrote this [Exhibit 1] late May the diagram says 38 per minute -- feet per minute plus or minus 10 percent, and when I revisited the report I asked myself was it really plus or minus 10 percent, and it turns out it wasn't that good.
Q. And you would agree with me that the airflow

coming out of the flow generator is not uniform.
A. That's correct.
Q. There's actually four sections of the flow generator; correct?
A. No. In this case --
All right. I think you have a misimpression. The four sections that are shown in --
Q. Let's go to page --
A. Yeah, page 9. [Exhibit 7.]
Q. Uh-huh.
A. -- are -- we just divided this up into fourths in order to take measurements in four quadrants, but in fact there aren't any dividers or anything as there are in the ceiling of an actual operating room.
Q. Okay. But you have different flow rates out of each section; correct?
A. There --
Depending on the measurements, there wa -- yes, there was differences in those flow rates.
Q. And we'll get that -- we'll get to that in a second.
So -- So the flow generator is a constant height except for the one testing that you've admitted that's not reliable so we're just going to scrap that

for today.
A. Very good.
Q. Okay. So for all -- So when I consider --
Let's talk about Exhibit 2 from now on. For all the testing that was done in Exhibit 2, the height of the flow generator was constant and the height of the table was constant.
A. This is correct.
Q. Okay. Now then you decided to do your testing; correct?
A. We reached a point with the downflow generator that we felt we'd -- more work on it was not going to yield a lot of improvement and it was time to move forward.
Q. Okay. And we'll talk about that when we put in the flow generator, I think that's going to be a big issue in this case.
The -- For the testing, once you got the flow generation to what you -- the best of your ability, correct, you decided to do testing with the flow on and the flow off for different scenarios; correct?
A. That is correct.
Q. You did the candle with it on and off; correct?

A. Yes.
Q. Okay. And you took pictures and videos; correct?
A. For every scenario there were, generally speaking, two still images and one, sometimes two, video clips.
Q. Okay. And in fact if you go to page 5, you produced pictures from the range of 40 to 329, whether or not they're videos or --
A. I'm sorry. Page 5 of which?
Q. Doesn't matter.
A. Now I was looking at the logbook. You're meaning page 5 --
Q. Yes. Yes.
A. -- of the report.
Q. Yes. Of your report.
A. All right. So could you repeat your question, please?
Q. On page 5 of your report if you look at eight lines up from the bottom --
A. Yes.
Q. -- it says, still clips and videos were done, I'm not going to -- I'm paraphrasing -- but DSC followed by the numbers of the range of 40 to 329; correct?

A. That's right.
Q. So basically there are approximately 289 images, whether or not they're video or -- or --
A. Two hundred and forty-nine --
Q. -- still or video.
A. Still or video.
Q. Okay. Did you produce those all to your counsel?
A. Yes.
Q. Okay. And it was in response to the subpoena; correct?
A. Correct.
Q. Okay. Are you aware that counsel has not produced all those videos or pictures to me?
A. I am.
Q. Okay. What was your understanding why that was not produced?
MR. GOSS: Calls for speculation. You don't have to provide any answer on that that we didn't discuss.
Q. What was your understanding that these weren't produced?
A. I don't have an understanding.
Q. Okay. Is there --
Are you afraid of what these pictures show?

A. Certainly not.
MR. GOSS: Object to form.
Q. Okay. So why weren't they produced?
MR. GOSS: Object to form.
A. All right.
MR. GOSS: They were provided to counsel. If not all of them were received, you can let me know and we'll review it.
MR. ASSAAD: Well you know they weren't received, counselor, and you intentionally did not produce them even after the letter by Ms. Zimmerman today -- for today's deposition.
MR. GOSS: You received a lot of videos, and it's my understanding that the ones that were not produced were either attorney work product, or they were redundant or duplicates of videos that were actually produced.
MR. ASSAAD: Counselor, --
MR. GOSS: That's what I can tell you.
MR. ASSAAD: Counselor, do you represent this client here today, your expert?
MR. GOSS: No, sir.
MR. ASSAAD: You don't? Okay.
MR. GOSS: He's my expert witness, and he's participating in this case as an expert witness.

MR. ASSAAD: So you don't represent him today as an attorney. You're not his attorney today.
MR. GOSS: He relied on us to handle the subpoena.
BY MR. ASSAAD:
Q. You understand you're under subpoena; correct?
A. Yes, sir.
Q. Is he representing you in this case?
MR. GOSS: With respect to the subpoena, yes.
Q. You understand a subpoena is equivalent to a court order.
A. Yes.
Q. Okay. And you complied with it; correct?
A. To the best of my ability I did.
Q. And it was your --
And it was 3M's attorneys' determination not to produce them to -- to counsel in this case; correct?
MR. GOSS: Calls for speculation, lack of foundation.
A. I don't know what happened after I produced the materials.
Q. It wasn't your decision not to produce these

today to us; correct?
A. It was not my decision.
Q. Okay. And I take it, as a scientist, you are not afraid of the information or you don't want to hold back information in any type of testing you did; correct?
A. I certainly do not.
Q. Okay. But today we can't talk about those pictures and images because they were not produced to us. You understand that; correct?
MR. GOSS: Objection to form.
Q. Do you understand that?
A. Let me answer the question this way. In my report, Exhibit 2, the images are -- that are shown and the videos that are called out are the ones that are pertinent to my opinions and my conclusions, and it's a selection from several hundred, some of which were duplicates, some of which were exposure tests where maybe as many as five or ten shots were made at different exposures, and so it's -- the report has the -- the results. We aren't withholding scientific information. No one's withholding scientific information, in my opinion.
Q. But you agree that I do not have all the pictures in this case; correct?

A. I don't know what you have, sir.
Q. Well you said you were aware that not all the pictures and videos were produced; correct?
A. All I know is I surrendered --
Q. Do you want me to go back to your testimony, sir?
MR. GOSS: Let's -- Can we move on from this?
Q. Do you want me to go back to your testimony?
MR. GOSS: We'll stipulate that you don't have 289 pictures. I don't know what happened.
My understanding in general is that there were some that were attorney work product, and some that were duplicates. You can take it up with me, and if there's a problem, we'll address it.
He's already said he doesn't know. He relied on -- He provided us the pictures, and whatever happened after that is up to counsel.
Q. You provided all the pictures that are claimed in this report; correct? Numbers 40 to 329; correct?
A. Some of those numbers had probably been deleted because they were simply blank or whatever, but every -- I presented -- I presented, upon subpoena, everything I had.

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Q. Okay. Any of the pictures you've taken, did they involve 3M being involved?
A. The one picture of Peter Goss on top of the surgical table was the only involvement, and that's not 3M, that's 3M's legal team.
Q. Okay. Well when I say "3M" I'm talking about -- I mean their legal team.
A. All right.
Q. Okay.
A. That was the only case.
Q. Okay. So besides that one picture, everything else was taken regarding the testing that was done; correct?
A. That's right.
Q. Okay.
MR. ASSAAD: I'd like to state for the record that you've been issued a subpoena, and I -- based on the information you've given to me I would like to say that I think you properly responded with respect to the pictures in the subpoena by producing them to 3M's legal team. And also state for the record that 3M's legal team has not produced all the pictures in this case after numerous depositions that indicated that they have intentionally failed to produce documents, and especially from a letter

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issued by Miss Zimmerman a couple days ago requesting that all documents relevant to the subpoena are being produced, that these pictures are quite obviously relevant to your -- to the testing that has been performed, except for that one picture of Peter Goss which personally I really don't want to see.
MR. GOSS: I think it was also produced, so.
MR. ASSAAD: Well -- So I'm going to hold this deposition open and I hope -- I just want to make you aware that counsel's inappropriate decision not to produce relevant documents pursuant to a court order that has no claim to any type of privilege is quite surprising and -- and therefore we will be asked that you're going to have to come again to discuss those pictures at a later day.
MR. GOSS: You don't have to respond to that, and I disagree on the record with some of the characterizations, but I don't need to get in the way of this deposition continuing.
MR. ASSAAD: Okay. All right.
BY MR. ASSAAD:
Q. So with all the testing -- and from now on when I talk about testing we're excluding the unreliable tests that you decided to omit from Exhibit

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2 -- you performed numerous tests with the Bair Hugger -- with the blower on -- the flow generator on and the flow generator off; correct?
A. That's right.
Q. Okay. And you also did tests with the Bair Hugger on and the Bair Hugger off; correct?
A. Correct.
Q. Okay. Now what was your methodology with respect to how long to test? For example, you turn on the flow generator, how long do you take a picture with the -- with the schlieren testing to get a result?
A. In other words --
I'm sorry. Can you -- Can I ask you to rephrase that and tell me whether or not you mean still image or video?
Q. Let's -- Let's put it this way. You -- The flow -- Like one of the tests you test, you know, what happens when you turn on the Bair Hugger above the -- when the image is, like, right above the mannequin; correct? You're looking at -- You're looking at --
A. Can you point to the --
Q. Okay.
A. -- the image in the report?
Q. And this is just for an example purposes.

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A. Yes.
Q. Okay? Let's go to image number 7, okay?
A. Figure 7.
Q. Figure 7.
Figure 4, I'm sorry, page 7. Figure 4, page 7. Okay.
A. Figure 4, page 7.
Q. Okay. Obviously figure A is a candle that the flow generator is off; correct?
A. Correct.
Q. And then you turn the flow generator on; correct?
A. In Figure 4 b, that is right.
Q. Yes.
How long do you wait for it to become to some sort of equilibrium or to see what happens with respect to the effect of the thermal plume of a candle before you take pictures?
A. In the candle case the change in the appearance of the candle that you see in these stills was almost immediate. The videos that I cited you will show that.
Q. Now let's take, for example, picture number -- Figure number 10, page 12. Okay.
A. All right.

Q. These are with the flow generator on; correct?
A. That is correct.
Q. Okay. And that's the HotDog and -- in Figure b and the Bair Hugger in figure a; correct?
A. That is correct.
Q. And the Bair Hugger's covered with a blanket; correct?
A. A Bair Hugger was covered with a cotton blanket and then the plastic drape.
Q. Okay. I don't see the plastic drape here, I just see a blanket.
A. Well you're looking at the plastic drape but it doesn't look like it because it's pink in one case and kind of grayish in the other, but it is a plastic drape over top -- the top of the cotton blanket.
Q. Okay. So let's step back a little bit before we get to this question.
So you place the mannequin on the table; correct?
A. Yes.
Q. Is that correct?
A. That's right.
Q. Okay. And then you cover it -- you put the Bair Hugger blanket on top of it; correct?

A. Yes.
Q. And how did you put the Bair Hugger blanket on top? Who did that, was that you or somebody else?
A. All right. The Bair Hugger and the HotDog blankets were applied by my -- members of my group, Lori and J. D. according to what they had learned from watching video of 3M and the -- their experience, and that was their job to put the blankets while I was doing the photography.
Q. Okay.
A. I checked to make sure that I was satisfied with what they did.
Q. Okay. Now the Bair Hugger blanket 522, did it have arm ties?
A. Yes.
Q. Were they attached?
A. They were.
Q. Okay. Did it have tape?
A. It did.
Q. And was it attached?
A. It was.
Q. Okay. And how well does the tape seal to a foam mannequin? If you know.
A. It -- From my observation of it it was a good seal.

Q. When did you observe it?
A. During these tests.
Q. Okay. At what day?
A. Well we could determine what day because, for example -- [clearing throat] excuse me -- for example, if we're talking about Figure 10, there are videos cited, 171 and 181, and in the logbook you have a log of all the video numbers. So in that particular case 171 and 181 would have been on -- would have been on May 11th of this year.
Q. Okay. Was May 11th the only time you tested the Bair Hugger blanket over --
A. No.
Q. -- on a mannequin?
A. No.
Q. Okay. What other days?
A. All right. So let's --
Then we can go back to, for example, Figure 7, and the video numbers here are 178 and 176, and I consult the logbook and those were -- well actually those were also May 11th.
Q. Okay. But Figure 7 is -- you're not really testing the blanket, you're testing just the blower.
A. That's right. It's an illustration.
Q. So was May 11th the only day that the Bair

Hugger was actually attached to a mannequin and tested to see the effects on the airflow?
A. I can answer that question, but I will have to check these numbers against the logbook to do so.
You want me to do that?
Q. Well let me rephrase it, then.
The only data that you provided in your report with respect to the Bair Hugger's effect on airflow are images in Figure 10, correct? Using schlieren testing.
A. Figure 10 and 11.
Q. Figures 10 and 11. Okay.
A. And that's 280. So 280 --
Give me just a moment. 280 was somewhat later. I believe that's May 15th. So at least on May 11th and May 15th these tests were done.
Q. And your testimony today is that you are confident that you tested --
Well let me ask you this: Between May 11th and May 15th did you disassemble the drape from the mannequin during that time period?
A. I would have to --
I cannot give you a good answer there. I would have to consult my colleagues on that. It may have remained in position the end of the May 11th test

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until we tested again on the 15th, but I would be guessing if I said that.
Q. On May 14th you did close-ups of the Bair Hugger exit jets, which is page 17 of your notes, Exhibit 3?
Is that Exhibit --
Is that Exhibit 3; am I correct?
A. Exhibit 7.
Q. Exhibit 7. I'm sorry.
A. Page 17. And figure --
Q. I don't need you to look at the figure.
My question is: When you did those Bair Hugger exit jets did you use a different Bair Hugger blanket, or did you -- or did you use the same setup as in Figures 10?
A. I'm sorry. I have to -- All right. So we're looking at Figure 7.
Q. Let me withdraw that question.
My understanding is you used a different schlieren mirror for the close-up; correct?
A. Oh, the close-up.
Q. Yes.
A. I'm sorry.
Q. Isn't that what you did on May 14th? You looked at the -- the exit jets, the close-ups of the

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exit jets?
A. That's not May 14th, sir, that is May 15th.
Q. Well if you go to page 17 of Exhibit 7 it says May 14th, 2017 GSS, which I assume is you, set up four and a half schlieren for close-ups of Bair Hugger exit jets.
Do you see that, sir?
A. Just a moment. (Witness reviewing exhibit.) All right. You are right. On May 14th the four-and-a-half inch schlieren system was set up for close-ups of the Bair Hugger exit jets, flow rate, so forth, and --
MR. GOSS: So wait for him to ask -- I think he just asked you if that was correct.
A. That's correct.
Q. Okay. And did you use the same blanket or a different blanket with respect to the close-ups?
A. That was a different brand new blanket out of its package.
Q. Okay. So would it be fair to say that between May 11th and May 15th it was most probable that you did not disassemble the setup of the Bair Hugger blanket on the mannequin?
A. It's a guess, and I'm not supposed to guess, but I could determine that. I could find out that

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information.
Q. Well unfortunately this is my one time to take your deposition.
A. I -- I understand that.
Q. Okay. So sitting here today you don't know one way or the other.
A. I don't know for sure.
Q. And sitting here today you don't know one way or another, like, how many times you checked the tape seal to the mannequin.
A. Well on occasions when it was removed and put back, for example, the Bair Hugger was -- blanket was removed and the HotDog blanket was used, then the tape seal would have been -- and the ties would have been restored and checked.
Q. And how many blankets did you say you had; less than five?
A. I can -- I can only say several. I don't have an exact count.
Q. Okay. Is there an inventory of what you received from 3M?
A. Not in writing, but I could produce that information.
Q. Why were you testing HotDog again?
A. Comparison.

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Q. Comparison. Why not the other patient-warming devices?
A. Within the scope of what we could do with the available time I felt that we could only do two cases for comparison, a force -- a forced blanket and a conduction blanket, and I -- I actually was not aware of the -- of other conduction blankets at that point.
Q. And just to refresh my recollection, you received the HotDog device from 3M; correct?
A. I believe 3M provided the device, yes.
Q. All right. So -- So you guys placed the blanket, the Bair Hugger blanket over the patient --
A. The mannequin, yes.
Q. The mannequin.
And you taped it; correct?
A. We taped it.
Q. Okay. Then you put a cotton blanket; correct?
A. Correct.
Q. Was that cotton blanket provided to you by 3M?
A. Not sure about that.
Q. Okay. Then a drape was placed over; correct?

A. Yeah.
Q. And --
A. Correct.
Q. -- did the drape expose the knee or not expose the knee?
A. It covered the knee.
Q. It covered the knee. So it was a solid drape; correct?
A. Solid drape.
Q. And was it set up similar to what's marked in Figure 12?
A. Figure 12 of my report.
Q. Yes.
A. Just one moment, please.
Figure 12, and for that matter 13, are drawings that I made of the setup. They are schematic, but yes, it was set up that way.
Q. Okay. So based on the schematic the drape doesn't go down to the floor; correct?
A. It does not.
Q. Okay. And do you know how -- what that distance is?
A. I can determine it, but I don't have an exact number right now.
Q. How would you determine it?

A. I'd measure it.
Q. If you went back to the --
A. Umm-hmm.
Q. -- to the -- to your --
A. Yes.
Q. Okay. But we can't do that today, can we?
A. No, we can't.
Q. Okay. Did the drape cover the feet or not cover the feet?
A. As shown here, it did not cover the feet.
Q. Okay. Did the drape cover the Bair Hugger blanket?
A. It did, although this diagram doesn't exactly make that clear.
Q. Did it cover the hands or not cover the hands?
A. If you will look at the next figure, then I've shown it covering the hands.
Q. Oh, I can't tell if that's the drape or the Bair Hugger blanket.
A. That's the drape.
Q. Okay.
A. It says "drape" on the lower left corner.
Q. Okay. Fair enough. I missed that.
Okay. Now before you did any testing did

you submit any pictures to 3M to say, this is our test setup, you know, is this what occurs in a typical operating room?
A. I did not.
Q. Okay. You did your sol --
This whole diagram and setup is totally based on a video provided to you by 3M; correct?
A. The video which was -- we found it -- we watched it on the internet, is just pertinent to the draping.
Q. That is my point. With respect to the draping.
A. That was our primary resource for draping, that's right.
Q. And there was only one drape; correct?
A. Yes. That's right.
Q. Okay. Do you know how many drapes are used in a typical knee or hip arthroplasty?
A. Well I know it's more elaborate than what we have here.
Q. Okay. And do you know whether or not the drapes are permeable or impermeable?
A. These are plastic drapes that appear to be impermeable.
Q. Okay. And do you know, in a typical

operation, surgical hip or knee arthroplasty, whether or not the drape covers the feet or not covers the feet?
A. In a hip arthroplasty.
Q. Or knee.
A. I don't know.
Q. Okay.
MR. GOSS: It's about 1:30, I'm getting a little peckish.
MR. ASSAAD: Okay. Let me just finish the methodology.
Q. Okay. So you do the setup here as what's in Figure 12; correct?
A. Figure 12.
Q. Okay. And is the draping the same with the Bair -- when you used the HotDog?
A. Yes.
Q. Okay. Did you use a blanket, cotton blanket over the HotDog?
A. Yes.
Q. Because I don't see a blanket over the HotDog in Figure Number 10.
A. One moment. I'll take... (Witness reviewing exhibit.)
Well, and actually I don't think you see it

in -- Figure 10 a is the Bair Hugger, and Figure 10 b is the HotDog, and the cotton blanket really isn't visible in either one, but we did use a cotton blanket in every case.

Q. Okay.

A. So it's there, it's just covered by the drape.

Q. Do you know whether or not the instructions for the HotDog require a cotton blanket?

A. I don't.

Q. Okay.

A. But I wanted to be -- I wanted these to be as comparable as possible.

Q. So you want to make things as exact as possible; correct?

A. I'm interested in the difference between the conduction blanket and the forced-air blanket, so I'd like to keep -- control conditions like that as much as possible.

Q. You try to --

You try to have as least amount of variables as possible; correct?

A. Least amount --

Least amount of variables as possible, control variables, yes.

Q. Okay. And you would agree with me that what you did in this experiment or this testing has many different variables and situations as to what goes on in an operating room; correct?

A. Well are you -- are you referring to the draping, or are you referring to something else?

Q. The airflow is different, what you did here than in an operating room; correct?

A. The downflow?

Q. Yeah.

A. We did our very best to provide the same face velocity on our downflow generator as what happens in the operating room, but --

Q. Your face velocity had an error of plus or minus 30 percent; correct?

A. Correct.

Q. Are the downflow airflow in an operating room have a velocity difference of plus or minus 30 percent?

A. More than that.

Q. You think so?

A. Look at the boundary conditions stated by Professor Elghobashi, and -- which I think he got from -- reasonably from louvered ceiling diffusers in an operating room, and you will see that there are

sections of filter and there are solid, I guess, support sections. So if you take face velocity across that you will go from a hundred percent downflow to zero, which is much more than the difference that we had.

Q. Do you think --

It's your testimony today that the airflow along the width or the length of the ventilation vent that Elghobashi used changes, or are you talking about the area where there are no vents?

A. The area where there are no vents, the solid.

Q. Okay. But we're not talking about that here because you had a solid diffuser -- flow generator; correct?

A. We're talking about it --

Or I'm talking about it because if you look at the downflow in the real operating room vents you've got a section that generates downflow and then you've got a dead zone. So then if you measure across you'll have a discrepancy, big discrepancy in velocity every time you come to the dead zone. The flow tends to even out due to turbulent mixing as it comes down.

My feeling on this is that if you get the face velocity right, the variations plus or minus tend

to come out in the wash, so to speak, in the turbulent mixing as the downflow falls.

Q. What was the face velocity right above the surgical site?

A. In our experiment.

Q. Yes.

A. It was 38 feet per minute plus or minus our tolerance.

Q. Where is that measured?

A. That's measured at four different locations below the downflow generator, --

Q. Where?

A. -- and averaged.

Q. Where below the downflow?

A. You'll see this in my logbook.

Q. Sure. What page?

A. Page 9, just below the center of the page on the left. And there's no physical division here, but we divided it up into fourths in order to take velocity readings, A, B, C and D, and then these readings are tabulated for tests in which we were trying to even the flow as much as we could.

Q. There was five feet between the top of the table and the bottom of the flow generator; correct?

A. That is -- according to the diagram on

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Figure 7, is correct.
Q. Okay. At what point did you -- did you test the flow, the velocity underneath the flow generator at?
A. That's face velocity, it's directly underneath the generator.
Q. Directly underneath --
A. Directly underneath.
Q. -- the generator; --
A. Yes.
Q. -- correct?
A. Face velocity.
Q. Okay.
A. That's the definition.
Q. So sitting here today you don't know when the -- when the different areas mixed, what the velocity was when it reached the mannequin; correct?
A. We -- We didn't take velocity profiles anywhere except face velocity.
Q. So the answer to my question is "that is correct, sir."
A. Could you repeat your question?
Q. You did not take any velocity measurements right above the -- where the -- above the mannequin during -- during your testing; correct?

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A. Not correct, because in the early testing you will -- I don't know how well annotated it is, but we began by placing the anemometer approximately one -- one and a half feet -- I don't want to guess. I can go look this measurement up or discuss it with my colleagues. And taking a measurement directly above the table like so. But then I realized that the pertinent measurement is the face velocity, not at any point directly above the mannequin.
Q. So let me ask you a question. Right above the knee, the surgical site in this case, you were pretending to be a knee surgery; correct? It was --
A. Yes.
Q. -- simulated of a knee surgery; correct?
A. Yes.
Q. What is the face velocity right above the knee?
A. "Face velocity," that term, refers to the measurement directly underneath the --
Q. Okay. I'm asking you this --
A. What is the --
You're asking what is the actual velocity.
Q. What's the actual face velocity right above the knee?
A. I --

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MR. GOSS: You can answer if you understand the question. If your --
MR. ASSAAD: He understands the question.
MR. GOSS: -- terminology is different, you can explain.
Q. Do you understand the question?
A. Well I understand the question, but I have to -- if you will beg my -- I beg your pardon, I have to correct your terminology.
"Face velocity" only refers to that measurement --
Q. Fair enough.
A. -- right here.
Where velocity --
Q. What is the velocity?
What's the velocity right above the knee?
A. We did not measure that.
Q. Okay. What's the velocity above the Bair Hugger blanket?
A. Once again, for -- for these tests that are shown here we measured only the face velocity, and this is -- I think you will see in the ASHRAE manual that this is how they check the flow rate and the performance in the actual clean room.
Q. Okay. Are you aware of any --

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Now we're talking a different face velocity along the entire flow generator; correct? The four -- The four by five foot --
A. Well there were differences.
Q. Different quadrants. Okay.
A. There were differences.
Q. And did you measure the center of each quadrant?
A. Yes.
Q. Okay. Now you agree with me that the -- based on the fact that there's different face velocities coming out of different quadrants, the air coming out of the flow generator has a much higher Reynolds number than what's probably coming out of an operating room vent.
A. I'm sorry. I don't understand that.
Q. You don't know what Reynolds number is?
A. Of course I know what Reynolds number is --
Q. Okay.
A. -- but I don't understand your --
Much higher where?
Q. Coming -- There's a Rey --
There's a velocity and a -- and a Reynolds number right below -- at the face velocity there's going to be a Reynolds number, correct, for each

quadrant?
A. If you know the velocity you could compute the Reynolds number, yes.
Q. And you know the velocity for each different quadrant; correct?
A. Yes. So there -- there would be a variation in Reynolds number --
Q. Okay.
A. -- due to the fact that there are variations in velocity.
Q. And it's your testimony today, just so I'm clear, that you believe that the air coming out of a duct -- and I'm not talking about the dead spots -- the actual diffuser, has different face velocities in an operating room?
MR. GOSS: Object to form, mischaracterizes. You can explain.
A. I don't have those data in --
Q. Okay.
A. -- an actual operating room.
Q. Okay. You would agree with me that if you look at Elghobashi's report, that yes, there are dead spots, but the face velocity coming out of each duct is constant.
A. That was his boundary condition, and I don't

disagree with it.
Q. And actually he created a -- a simulated duct going up --
A. Yes.
Q. -- to show --
A. I know.
Q. -- that that needs to be calculated to get the right face velocity; correct?
MR. GOSS: Please wait for him to finish his question, then you can answer.
Q. Correct?
A. He created a simulated duct. Yes. Correct.
Q. Dr. Abraham did not do that; correct?
A. I don't think so.
Q. Okay. And would it be fair that you do not know the mass flow coming out of each quadrant; correct?
A. I can certainly -- [clearing throat] excuse me.
I can certainly calculate it, because I know the velocity. It's a constant density/constant pressure situation.
Q. Okay. But then you would agree with me that since there's different velocities coming out of the different qua -- the theoretical quadrants of the flow

generator, there'll be different mass flows.
A. At the face.
Q. Okay. And you mentioned before that at some point it would just all mix together and be constant; correct?
A. It certainly mixes out, and this is why in the -- the clean -- in the operating room the lands between these diffusers don't really end up having an effect when you get down to the patient level. They don't create dead spots because turbulent mixing mixes this out.
Q. You agree but all the diffusers are at a constant face velocity; correct?
MR. GOSS: Object to form. Which diffusers?
Q. They spend a --
They spend a lot of money designing HVAC systems --
A. Well, right.
Q. -- for ORs; correct?
A. I don't know the face velocity.
Q. Okay. So you -- you don't know one way or another whether or not the face velocities for each of the --
A. I could --

Q. -- each of the diffusers --
A. I could make --
(Interruption by the reporter.)
Q. -- for each of the diffusers are a constant or not; correct?
A. I would be guessing.
Q. Okay. Now the flow generator did not provide any cooling effect; correct? It was taking room temperature air and just blowing it down; correct?
A. That's correct.
Q. That's different than what occurs in an OR; correct?
A. I think it is different, yes.
Q. I mean the cooling effect, the cold air coming in an OR is from the diffusers up top; correct?
A. Yes.
Q. Okay. So that is another variable that is not accounted for in your testing; correct?
A. What is another variable?
Q. The difference in temperature between the air supply and the rest of the room.
A. I'm trying to understand your question. Is --
Q. Where --

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Let me rephrase it. You have this warehouse; correct?
A. Yes.
Q. What's the HVAC system in the warehouse?
A. There is -- [Clearing throat] is no HVAC system. It's open air.
Q. It's open air?
A. It's open to the outside by way of windows and a -- and a large garage door. It's not ventilated.
Q. So it's an unventilated --
A. It's unventilated.
Q. So the temperature is -- is based on what the outside temperature is?
A. Similar to the outside temperature.
Q. Okay. Is it warmer or colder than the outside temperature?
A. Depends on circumstances.
Q. Well with the windows closed is it warmer or colder? With everything closed does it warm up inside at all?
A. We measured the temperature on the inside. I don't have --
Q. Sir, I know what you did, --
A. -- very good measurements on the outside.

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Q. -- I read your report.
Just answer my question, please.
A. Could you repeat the question?
Q. Does the air --
When you close all the windows and the garage, does the air get warmer inside the warehouse?
A. We never had a situation when it was hermetically sealed like that.
Q. Okay.
A. We kept it ventilated to the outside.
Q. What temperature of -- was the air that the flow generator was drawing from?
A. In -- In general, the same temperature as the room air that would be measured by a thermocouple in the room.
Q. Okay. During your testing were the windows open?
A. There was -- I wouldn't say windows.
There was ventilation to the outside to maintain -- to avoid pressure changes.
Q. Let's talk about pressure.
A. All right.
Q. Was it --
Was the area positively pressured?
A. No.

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Q. No.
A. This is --
Q. Just answer my questions. That's all I'm asking.
A. No.
Q. "No." Okay.
Was the garage door open?
A. In some cases.
Q. Okay. So in some cases they were, in some cases they weren't?
A. I'm saying that the communication to the outside could be by way of a partially opened garage door or by windows.
Q. Was that --
Was that taken into account to keep the variables as least as possible when you were doing your testing?
A. It was generally to just avoid pressurization or avoid pressure differences from the inside to outside.
Q. Okay. You didn't measure pressure throughout your whole testing; correct?
A. Well the assumption is, and the pressure was assumed, we didn't measure it, is local barometric pressure.

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Q. Okay. You agree with me that --
Let's be realistic. You agree with me you didn't simulate an OR in your experiments; correct?
A. We did a simulation of the downflow --
Q. That wasn't my question. That wasn't my question, sir.
MR. GOSS: Wait. Let him answer.
MR. ASSAAD: No. I want him to answer my questions. If you want to ask him questions, you can.
Q. Answer my question.
MR. GOSS: He's going to answer your question --
Q. Did you simulate --
MR. GOSS: -- to the best of his abilities.
Q. -- an operating room in this case?
A. Are you referring to a perfect simulation in every respect?
Q. To any operating room you've ever seen.
Is there any operating room that this simulates; from the size, to the amount of people, to the airflow, to the pressure, to the devices inside the operating room?
A. No.
Q. Okay. You agree with me that all those

variables; the size of the room, as we discussed before, pressure, temperature gradient, persons, affect the airflow in an operating room. In a room in general, but especially in an operating room; correct?
A. I'm sorry. I didn't hear a question there.
Q. You agree with me that people, heat sources --
A. Oh, "affect."
Q. Okay.
-- the air supply, the air return, the pressure and other heat sources affect the airflow in an operating room; correct?
A. Correct.
Q. Okay. Do you know what effect on your results if the cooling load of the room was provided through the flow generator in which the air coming out of there would have been 59 degrees or 60 degrees Celsius?
A. I'm -- I don't know how to answer that as phrased.
Are you asking if I were to provide cooled air rather than room temperature air?
Q. Yes.
A. As far as what we were trying to do I don't think it makes a lot of difference.

Q. Okay. But it could make a difference.
A. I don't think so.
Q. And your basis behind that?
A. We are trying to see the --
We're not trying to simulate a whole clean room in all that de -- or operating room in all that detail. We're trying to see the downflow and its interaction locally with patient-warming blankets and with a mannequin on top of a surgical table. It's a -- the subsection, the core of the operating room. Simulating the entire operating room was not feasible.
Q. First law of thermodynamics, conservation of energy; correct?
A. First law of thermodynamics is the conservation of energy principle.
Q. And you don't disagree with that, the first law of thermodynamics.
A. I'd be a fool to disagree with that.
Q. Okay. You would agree that if you took a room such as this, kept everything the same and we put a Bair Hugger in here and left it on, at some point the temperature would increase; correct?
A. What temperature?
Q. Room temperature.
A. Are you assuming a closed room? What

about --
Q. Exactly this room.
A. -- the ventilation?
Q. Ventilation's on.
A. It's a question of whether the ventilation could handle the heat load provided by the Bair Hugger, and I don't know the answer to that.
Q. Well everything's constant, okay? So where would that energy go that -- of blowing into the air? You'd have to agree that it raises -- it might not raise it significantly, but it's going to raise it at some point.
A. Steady state it would raise the temperature slightly.
Q. Okay. By the way, was your experiments at steady state?
A. We tried to be, yes.
Q. But were they?
A. Yes.
Q. Okay.
MR. GOSS: Are we about done with methodology?
MR. ASSAAD: No, not yet. Give me 10 more minutes.
Q. Now --

MR. GOSS: I'll try not to eat my hand.
MR. ASSAAD: That's fine.
BY MR. ASSAAD:
Q. Now with -- Let's move on.
So you have the flow generator on and off and the Bair Hugger on and off for different -- okay, for different testing, okay. So you set up the patient and you look and you do schlieren testing with the Bair Hugger -- with the flow generation off -- Strike that.
Did you do any testing with the flow generator off and the Bair Hugger on?
A. I think we have an image. I'm not sure. (Witness reviewing exhibit.) All right. The images that I've reported here were all with the downflow on. And your question is did we do any image with the downflow off --
Q. Yes.
A. -- and the Bair Hugger on.
I'm going to have to check the logbook, but I can answer that. I can't give you an immediate answer.
Q. Okay. Now you turned -- you --
So let me get this straight. You -- You set it up with the blanket, the Bair Hugger blanket, the

cotton blanket and the drape on the mannequin, you check everything and the flow generator is on; correct?
A. During setup.
Q. Or before you start the testing.
A. Well in --
I mean if you look at these cases that I cite, most of the cases are with the downflow generator on.
Q. Okay. The downflow generator's on, everything is set up, the mirrors are correct, this and that.
A. Yes.
Q. Okay. And you filmed -- you do a schlieren pictures with the Bair Hugger off; correct?
A. "Off."
Q. Yes. Because you want to see the change; correct?
A. Yes.
Q. Okay. It might not be depicted here, but I --
A. Yes. Yes.
Q. -- I'm going to assume that you told me you took pictures with it off; okay?
I don't have those pictures, but supposedly

they're taken. Okay?
MR. GOSS: You may not know if you have those pictures.
MR. ASSAAD: Okay.
Q. Then what do you do next? What's the protocol, where -- where are people standing when you start taking -- before you turn the Bair Hugger on?
A. Do you want me to answer the last part of that question?
Q. Let's start where people are standing.
A. All right. During the taking of the data I'm standing at the camera position, which I can indicate to you if you're interested.
Q. I know where the camera position is. That's fine.
A. All right. It's -- you know it's a diagram of the optical system. And the other personnel are out of the pic -- out of the picture, they're standing away in order not to interfere with the flow.
Q. Who's turning on the Bair Hugger?
A. J. D. Miller.
Q. Okay. And where is he standing?
A. Well when he's turning it on he's there at the Bair Hugger unit, and then when it's reached its temperature it gives a signal and then he goes and

stands away from the experiment.
Q. Okay. And so when -- when the -- you're looking at -- you're talking the monitor of the little LED device; correct?
A. Yes.
Q. So when it hits 43 degrees is that when he stands away and says, okay, it's 43?
A. Yes.
Q. And then what do you do?
A. Give it some time, make sure that everything has reached steady state, and then I take data, still images and videos.
Q. With the camera.
A. With the camera.
Q. Okay. Now --
But when you say "time," what's time? What's steady state?
A. I'm observing the schlieren picture, and so when I visually observe and I'm not seeing visible changes then I think we've reached steady state.
Q. Okay.
A. We have a live video on our large monitor.
Q. Okay. And do you roughly know how long that took?
A. Not very long. Probably a minute.

Q. One minute?
So you turn on the Bair Hugger device, J. D. turns on the Bair Hugger device, gets out of the way; is that correct?
A. Let me say that the Bair Hugger device has been -- takes a long time to warm up.
Q. Well once it gets to 43.
A. Once it reaches, then he gets out of the way.
Q. Okay. So once the Bair Hugger hits 43 degrees he gets out of the way; correct?
A. Yes.
Q. Then you wait about a minute and then start videoing, correct, or pictures and video?
A. Assuming that I'm not seeing any variations in anything on the schlieren image, that's right.
Q. Okay. And your images are about 10 seconds long; correct?
A. The videos --
Q. Yes.
A. -- are about 10 seconds long.
Q. That's what I meant.
And then you do the tests and then you go shut off the Bair Hugger?
A. Depends on what the test protocol was at the

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time, but if we're done with the Bair Hugger we shut it off.
Q. Okay. How many times did you conduct the test of the Bair Hugger being turned on and doing schlieren imaging of like the area above the mannequin?
A. I can determine that by studying the logbook. I don't have a number right immediately available.
Q. Okay. All right. Now did you bring your original logbook today?
A. No.
Q. Okay. So the logbook is what we've been provided. Is that a complete copy of your logbook, you know, besides what's been redacted?
A. It is. It ends, if you look at the last page, "END OF LAB NOTEBOOK," signed by me.
Q. Okay. And if we go to page, I believe, 17, that's the day that you did testing with respect to the Bair Hugger on the mannequin; correct?
MR. GOSS: 17 of the report, or --
MR. ASSAAD: Of the logbook, Exhibit 7.
A. May 11th, Bair Hugger mannequin, arms were out, blanket, hip drape.
Q. Okay.

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A. Downflow is initially off, then turned on, and you can see the -- the numbers indicating the --
Q. Okay.
A. -- stills and videos that were taken.
Q. Okay. And so you have all these numbers here. What's the difference between 170, 171, 172, 173, 175, 176?
A. All right. If you read across in lines you'll see that 170 and 171 are just the Bair Hugger, and then in the next line down are -- this is my shorthand, J. D. is my assistant, J. D. Miller and he's dressed up in -- in medical garb and he's in the picture. So he's simulating an operat -- doctor or an operating room personnel.
Q. And that's depicted in Figure 15; correct?
A. For example --
Yes. One minute. Let me check. Figure fif -- Yes. Figure 15 a and b show him, and d.
Q. Okay. So let me just ask you this real quick. Between 170 and pictures 195, this was all during one setup; correct?
A. It was all during one setup I believe, yes.
Q. And how long did it take to do all this, from the first picture of 170 to the last one of 195?
A. Well we haven't recorded a timestamp, so I'm

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-- I would have to give you an estimate. I think we spent all of a morning doing this work.
Q. So it took you -- the Bair Hugger was on from -- from the time from 170 to 195 continuously?
A. That -- The morning was -- included setup and so forth, so the time during which these images were taken would have been less than four hours, but proba -- I'm guessing. I really don't know.
Q. Well, I don't -- I don't have J. D. here, I have you, so I need to figure out, like, your methodology.
So was the Bair Hugger ever turned off between the first picture of 170 and the last picture of 195? Well, I'm sorry. Let me rephrase that.
At 180 you change it to the HotDog; correct?
A. That's right.
Q. Okay. And 176 is the Bair Hugger hose jet and the hairdryer.
A. Yes.
Q. So basically with the Bair Hugger setup it's between 170 and 176; correct?
A. Correct.
Q. Okay. And 170 and 171 are still pictures; correct? Or no. 171's a video.
A. I have to check.

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Q. It's a video in your report, --
A. All right.
Q. -- let's just assume that it is.
And 172, 173 and 174 are a video with J. D. as being the doctor.
A. Correct.
Q. And then 175, 176, what does that say?
A. "Refocused." Sometimes there's a focusing issue to make sure that we have a sharp image, and I have to check it.
Q. So that was just more of a checks and balances?
A. Well it was about readjusting the optical system, let's say.
Q. And was that to do the Bair Hugger hose jet?
A. No. Well that was refocused between 174 and 176.
Q. But by 174 you stopped testing the Bair Hugger as a -- attached to the blanket; correct?
A. I believe that's correct.
Q. Okay. And when you did 172 --
Okay. I'm almost done here before we take a break.
So between 170 and 174 give me an approximation, did it take 15 minutes, 10 minutes to

do? Five?
A. Let's say a half hour.
Q. It took a half hour --
A. Well --
Q. -- to do two -- to do one still shot, one 10-second video, another 10-second video, another 10-second video and another 10-second video?
A. Well remember that we were -- 170 and 171 are without personnel involved, and then we had a -- one of the -- one of our people step in, and he had to get gowned up, so I believe there was a break. But once again, I don't have time steps here, so.
Q. Well let me ask you this. Does the -- Does the photographs have timestamps?
A. No. The photographs don't have a --
That's a good question. I don't know the answer to that.
Q. My understanding is you take a picture, it'll have a -- at least when you look at the file the file will have a timestamp.
A. I'd have to check it, but you're probably right.
Q. Okay.
MR. ASSAAD: I request the original files with the timestamps to be produced, and not

timestamps removed, as you provided them to us.
MR. GOSS: I'm not aware that we removed anything.
MR. ASSAAD: Really? Because if you look at them they're all on the same date and time.
MR. GOSS: Well I -- I'm not aware that we made any manipulation at all to the timestamps in those photographs or videos.
MR. ASSAAD: Okay.
BY MR. ASSAAD:
Q. So between 170 and 172 did you turn the Bair Hugger off before you -- so J. D. could dress up?
A. No. It was left on, in my recollection.
Q. Okay. It was left on? Okay.
MR. ASSAAD: Let's take a break, lunch.
THE REPORTER: Off the record, please.
(Luncheon recess taken at approximately 2:02 p.m.)

AFTERNOON SESSION
(Deposition reconvened at approximately 2:48 p.m.)
BY MR. ASSAAD:
Q. I'd like you to turn to page 16 of your -- of Exhibit 7, of your notes.
A. Yes.
Q. I want -- I'm looking at the -- the velocity, the face velocity measurements --
A. Yes.
Q. -- right where it says "5/11/17" with the average of 39?
A. Yes.
Q. It says "throttle 17." What does that mean?
A. The throttle on the engine that drives the blower. We set the average value by changing that throttle.
Q. Okay. And how'd you calculate the average?
A. It's a simple average of those four numbers.
Q. So basically the 39, is that feet per second?
A. Feet per minute.
Q. "Feet per minute." I'm sorry.
Feet per minute, that's based on the average of those four numbers; right?

A. That's correct.
Q. And those four numbers are at discrete points in the -- in the quadrants; correct?
A. Center of the quadrants.
Q. The center.
And do you have any opinion of whether or not the face velocity is constant throughout each quadrant?
A. No. Only those center measurements, those four.
Q. So sitting here today, you don't have any basis to support that the true average face velocity is 39 of -- of the entire flow generator.
MR. GOSS: Object to form.
MR. ASSAAD: Basis?
MR. GOSS: I think he said he took these measurements and he averaged them, so that's his basis.
Q. Do you understand my question?
A. I understand your question.
Q. You're only taking four discrete points; correct?
A. Four discrete points.
Q. And we're talking about a system that's four point -- four by five; correct?

A. Correct.
Q. Divided into four equal quadrants; correct?
A. Yes.
Q. So you're basing the average face velocity on four discrete points; correct?
A. That's right.
Q. And to do that you have to assume that each quadrant has the same mass flow; correct?
A. Correct.
Q. And the same face velocity.
A. Correct.
Q. And we are absolutely certain, sitting here today, that each quadrant has a different face velocity at the points that you've taken; correct?
A. Well that's what these measurements show.
Q. So we could agree to that today; correct?
A. We can.
Q. Okay. And we could say more likely than not that the face velocity will be different at each point you take in each quadrant.
A. I'm not understanding that.
Q. Well if you move the -- the -- the anemometer, say, three inches to the right or left instead of the center, more likely than not it's going to be a different face velocity; correct?

A. Let me answer that as best I can. If you -- Suppose we had decided, well, let's take eight, so let's divide the area up so that there are eight instead of four, it would more likely than not, make a difference in the average, but I think it would be a small difference. And if you went to 16 I think it would be an unnoticeable difference.
Q. Well between quadrant A and quadrant C we're seeing a Delta of about 23 feet per second; correct?
A. Right.
Q. That --
If you look at that Delta between those two that's a huge standard deviation.
A. Between those two it is, yes.
Q. Okay. So give me the range, based on your education, training and experience, of what the -- the -- the extremes, the Delta, not the standard deviation, would be on the average here.
A. That's --
Standard deviation's 12 on these measurements, twelve feet per minute.
Q. Twelve feet.
A. Which is about 30 percent of --
Q. And how'd you calc -- I'm sorry.
A. Sorry.

Q. How did you calculate the standard deviation?
A. Standard deviation code in Excel.
Q. In Excel. Okay.
Why didn't you take more data points, if you -- if you realized that each quadrant's giving you a significantly different face velocity?
A. I think I answered it. You could take more data and it would make -- up to a point it would make a little -- it would make some difference, and then more and more data points would not make any difference any more.
Q. So technically speaking based on your standard deviation, the schlieren testing that you performed on this day could have a face velocity up to 51 feet per minute; correct?
A. Fifty-four, yeah.
Q. Or 51 if you took the average and did the standard deviation of 12 it could have up to --
A. I see.
Q. -- fifty -- 51 feet per minute.
A. I'm sorry. What is -- What is the 51 feet per minute?
Q. If you took the standard deviation, you could have --

If you looked at the standard deviation you provided of 12, --
A. Twelve.
Q. -- that -- at any given point the face velocity could be 51 feet per second.
A. I do not see that.
We are providing the face velocity at four points. Standard deviation is 12 feet per minute. [Clearing throat.] I'm sorry.
So in A if you subtract 12 that would be 42, and in D if you add 12 that would be 39. I didn't --
[Water provided to the witness.]
THE WITNESS: That's okay. I'll use the soda.
A. I didn't understand --
Q. Okay.
A. -- the way you phrased it.
Q. Okay. My understanding of standard deviation is a range within the -- I guess it's the 66th percentile up and down, correct, of where you would expect --
A. It's a statistical measure of deviance of data points.
Q. Uh-huh. And based on my understanding, based on the standard deviation and the average, that

when you run the schlieren video you could have a average face velocity larger than 39; correct?
A. You are suggesting if we had taken more data points then that would have yielded a different average face velocity.
MR. GOSS: Listen to his question.
Q. You made the average off four data points; correct?
A. Four data points.
Q. Okay. And it has a standard deviation, which means that -- a standard deviation of 12 means a range in which -- a certain area within a bell curve or -- that you might find specific data; correct?
A. Correct.
Q. And therefore, depending on the mass flow and the way the flow generator is running based on the data, that you have a face velocity of 39 plus or minus 12 standard deviation; correct?
A. That's it, yes.
Q. Okay. Which means that at any given point in time the face velocity being produced by the flow -- downward flow generator could be up to -- within that bell curve, up to 51.
A. One standard deviation from the average we have there would be 51, that's right.

Q. Okay. And it could be as low as, under the -- under your statistical analysis, as low as 27.
A. All right.
Q. Okay. So sitting here today when you took the -- the images of the -- the schlieren images say, for example, in Exhibit 2, Figure 10, page 12, you can't tell me the exact face velocity that was occurring at that specific point in time that was being generated by the flow generator; can you?
A. Sure. 39, plus or minus standard deviation, which is 12.
Q. Okay. I'm asking for exact.
A. That's the best data we have.
Q. Okay. So you can't give me an exact number.
MR. GOSS: Object, asked and answered.
A. Asked and answered.
Q. Is it 40?
It could be 40; correct?
A. I've already answered you, sir.
Q. But it could be 40; correct?
A. It could be.
Q. It could be 45.
A. The difference between 39 and 40 is a trivial difference.
Q. What about the difference between 39 and 52;

is that trivial as well?
A. And remember --
No, it's not trivial.
Q. Okay. Do you agree with me, or --
If you know the answer. Do you agree with me that the face velocity of a -- of an operating room diffuser has a much smaller standard deviation than plus or minus 12?
A. I'm not aware of that.
Q. You don't know one way or the other; correct?
A. No, I don't.
Q. Okay. And you agree with me that the face velocity will have an effect on buoyancy produced -- buoyancy currents produced by the Bair Hugger.
A. The face velocity is the way that these type units are measured. The flow tends to average out with distance. If there are differences when the flow reaches the Bair Hugger that are significant, then I would agree with that statement.
Q. What would you consider significant?
A. Thirty-nine feet per minute. Fifty percent.
Q. Fifty percent difference would be significant.
A. That would be significant.

Q. What about a 20 percent difference?
A. I'm not so sure.
Q. What about a 10 percent difference?
A. I don't think that's significant.
Q. Okay. You agree with me that with respect to the convection currents -- Let me rewind.
The images that we're seeing that are coming off the Bair Hugger are convection currents; correct?
A. You're referring to Figure 10?
Q. Yes.
A. Those are convection currents.
Q. Okay. And you agree with me that there is a convection current -- a convection current force that's being opposed by the downward air force -- the downward flow force; correct?
A. In other words, a buoyant force in the convection current and the downward air force --
Q. Yes.
A. -- opposing one another. I agree with that.
Q. Okay. And do you know the calculations to determine the different forces? Would that be the Navier-Stokes equations?
A. Yes.
(Interruption by the reporter.)
A. Yes. I know the Navier-Stokes equations.

Q. Okay. And of course temperature is a component of the Navier-Stokes equation; correct?
A. If there are temperature differences it comes into the energy equation that is part -- goes along with --
Navier-Stokes equation is a momentum equation.
Q. Okay. Do you agree with me that the amount of mass flow would take -- takes into account the Navier-Stokes equations; correct?
A. "Amount of mass flow." I am sorry. Could you rephrase?
Q. The mass flow --
In this situation there's a mass flow coming out of the downflow generators.
A. All right. The Navier-Stokes equations are basically an expression for -- for Newton's second law of motion, F=ma, and that includes mass flow if you multiply both sides by row, yes.
Q. Okay. Did you do a calculation at all to determine whether or not that standard deviation, if you took the max or the min, it would have an effect on your results?
A. I did not do that calculation.
Q. Did you do any testing to determine whether

or not a change in the average face velocity with a standard deviation would have an effect on your results?
A. No.
Q. Okay. And in fact you would agree with me that the average face velocity changed on every given day that you turned this machine on.
A. Well those data are here, but it didn't change a lot. We set it average at 41. I have to go back a few page -- No. Wait a minute.
Well we were still -- Yeah. 5 May, 44 and a half was the average, and in -- that was on page --
Q. I have that.
A. -- 15. And on page 16, 39 was the average.
Q. Okay.
A. We were checking the face velocity every day.
Q. Okay. What was the face velocity on May 15th?
A. I have not recorded a face velocity for that day.
Q. So sitting here today we don't know what the face velocity is on May 15th; correct?
A. The assumption was that we had gotten the face velocity at 39, which is essentially the desired

value with the throttle setting of 17, and we could go right back to that throttle setting and expect the same face velocity. We did check it later, but I apparently did not record it on that day, no.
Q. Well let's go back to that, because your throttle setting was 17 on May 5th, and you had a face velocity of 44.5 average; correct?
A. One second, please. [Witness reviewing exhibit.] Yeah, same throttle setting in both those cases.
Q. So the fa --
You can't sit here and assume that because the throttle setting is at -- is at 17 that the face velocity could be 39, because we have experimental evidence that such is not the case; correct?
A. Correct. But note that there's only a 10 percent difference in those averages, --
Q. Okay.
A. -- 39 to 44. So that's experimental error.
(Interruption by the reporter.)
Q. According to who?
A. Myself.
Q. Okay. And what do you have to base that a 10 percent error is accepted in this -- in this type of study?

A. This is my judgment based on the experiment that I was performing.
Q. So my understanding is it's your judgment and you have no scientific basis besides your judgment?
A. Experimental error can be one percent in some situations and 50 percent in others.
Q. I agree, and you have to look at every situation to determine what is an acceptable experimental error; correct?
A. What do you mean "every situation"?
Q. For example, if I'm going to -- if I'm designing a rocket --
A. Okay.
Q. -- that goes into space...
Well let's put it this way. You don't want -- You don't want to fly back home or take an airplane that has an experimental error of 10 percent; do you? Correct?
A. I don't --
Q. Okay.
A. -- know -- [Clearing throat.] Excuse me. [Clearing throat.]
I don't know what an experimental error of 10 percent means in that scenario. [Clearing throat.]

Excuse me a second.
Q. In this scenario, an experimental error of 10 percent, what's -- when you say that's okay, you have to have some sort of experimental data to support that. Ten percent is not going to give us different results; will it?
MR. GOSS: Objection to form.
A. Ten percent was our goal, and considered to be, with a device of this type, a good experimental error. Unfortunately, we didn't quite achieve it.
Q. You didn't --
You didn't achieve 10 percent error.
A. Didn't achieve 10 percent, no.
Q. You got much greater than 10 percent; correct?
A. It was --
MR. GOSS: Object to form.
A. -- significantly greater.
(Interruption by the reporter.)
Q. Okay. And the fact that it's significantly greater, you agree with me that that takes away from the persuasiveness of the experimental results; correct?
MR. GOSS: Objection form, calls for speculation.

A. I'll answer that question by saying that we're not doing PIV here and measuring quantitative values, it's a flow visualization. And in my experience with the schlieren system, a 10 percent error in flow velocities in a scenario like this where the flow mixes out with distance is not going to make a significant change in the visualizations that you're seeing in these images.
Q. When you did --
When you took the pictures of Figure 10 a, did you at that time measure the temperature of the knee or the drape on top of the patient?
A. One moment while I have a look here.
THE WITNESS: Sorry.
A. So that was done on May 11, and the -- those temperature measurements were done on May 15th, so the answer is no, not on the same day.
Q. Okay. You agree with me that based on your temperature measurements that the air -- the area underneath the operating room table increased in temperature; correct?
A. Increased in temperature due to what?
Q. The Bair Hugger being on.
A. Well I don't have measurements here of temperature when the Bair Hugger is off.

Q. So when you basically said that the Bair Hugger doesn't cause convection currents coming from under the drape and you -- you said your support was Figure 12 because Figure 11 a is no longer reliable, what was your basis behind that?
A. Your --
What are you referring to, my -- my conclusions?
Q. No. Referring to Figure 12.
A. No. You said when I said so and so.
Q. Well you mentioned earlier in the deposition that Figure 11 a is no longer reliable and that's why you omitted it from Exhibit 2.
A. That is correct.
Q. Okay. And therefore --
And that was to show convection currents underneath -- around the drape or underneath the drape; correct?
A. That was the purpose, but it was flawed and so it was removed.
Q. And you said, but I can make that opinion because I'm relying on Figure 12, because you took temperature measurements; correct?
A. I don't remember saying that.
Q. Okay. So you have no opinion, sitting here

today, that the Bair Hugger -- with respect to what the Bair Hugger caused with convection currents coming from underneath the operating room table; correct?
A. Unfortunately we weren't able to make a measurement to address that.
Q. Okay. So sitting here today you have no opinion with respect to whether or not convection currents occur from underneath the operating room table; correct?
A. Well I'll just point out that there is a temperature difference from room temperature, but beyond that I don't have schlieren evidence to show convection currents underneath the table.
Q. So you're no longer offering any opinion with respect to that in your report or at trial; correct?
MR. GOSS: With respect to the Bair Hugger forming convection currents under the operating table?
MR. ASSAAD: Yes.
A. That's -- That's correct.
Q. Okay. Now what is your understanding of how the Bair Hugger works with respect to patient warming?
A. I'll answer that question by referring to Figure 8 b and Figure 9. And those measurements show

the micro-jets coming from the already discussed hundreds of orifices, and these are warm air micro-jets with a temperature I measured to be 32 to 33 degrees C at the exit, but mixing out quickly to room temperature.

Q. Okay.

A. And so my understanding of the function of the Bair Hugger blanket is that it is those warm air micro-jets impinging on the patient that accomplishes the chore of warming the patient.

Q. Okay. Now let's talk about heat transfer.

A. Okay.

Q. You agree with me that when you have two materials heat will transfer from the hotter material to the colder material.

A. I agree with that.

Q. Okay. So, for example, if you put a -- a cold pot of water on the stove and you put -- you turn on the gas, you'll get heat transfer from the gas to the cold water; correct?

A. Yes.

Q. Okay. Basically the law of thermodynamics basically states that it goes from -- from higher energy to lower energy; correct? That's probably the wrong term to use, but to that effect.

A. I believe that that's -- could be stated as a corollary of the second law or a form of the second law.

Q. Okay. And the second law is what?

A. That entropy increases in the universe.

Q. Okay. And entropy is disorder. It goes from --

A. Right.

Q. -- order to disorder; correct?

A. Yes.

Q. I don't know if Peter Goss told you, but I studied mechanical engineering in undergrad.

A. He did. Florida, I believe.

Q. Yeah. Figured he told -- probably told you a lot about me.

A. No, just that.

(Laughter.)

Q. So for --

And what is, your understanding, the skin temperature of a person around the core?

A. Well a healthy person would have a core temperature that's typically referred to as 98.6 Fahrenheit. The room temperature in this -- in these cases, just to take an example, was 17, and the skin temperature would be between those two, and probably

closer to the air than to the core temperature.

Am I answering your question?

Q. So it's your understanding that the skin temperature of a person is closer to the ambient temperature than the core temperature?

A. I'm not sure of that, but it's somewhere between the two.

Q. Okay. Do you know what hypothermia is?

A. Yes.

Q. Used in this case by anesthesiologists, do you know what the definition of hypothermia is?

A. Yes.

Q. What is it?

A. I'll give you --

And I'll phrase it in my terms. It is a depression of the body core temperature during anesthesia.

Q. Okay. And what is the threshold that peo -- that pa -- that anesthesiologists would say this person is hypothermic or not. Do you know what temperature?

A. I don't know.

Q. Okay. Do you know what the average temperature of a patient is when they're under anesthesia if they become hypothermic, the range? Do

you know what the range would be?

A. You're talking the body core temperature now.

Q. Yes.

A. I don't know that number.

Q. Okay. If the core temperature is 36 degrees and you're blowing 33 degree -- 32 to 33 degree air on the core, would you agree with me that it would have a cooling effect?

A. Well 36 degree core, 33 degree skin suggests, according to the discussion, that there would be heat transfer and cool -- cool the surface slightly, yeah.

Q. I'm not saying 33 degree skin, I'm saying 33 degree air.

A. Thirty --

Q. 33 degree air on a 36 degree body, would you agree with me that would cause a cooling effect, according to the second law of thermodynamics?

A. Once again, 36 degree body core temperature, --

Q. Yeah.

A. -- 33 degree Centigrade skin temperature.

Q. No. 33 degree --

A. Cool air temperature.

Q. -- cool air temperature.
A. All right.
MR. GOSS: I'm just going to object that we're not offering him for opinions in heat transfer or normothermia. If you know, you can answer.
A. As you posed it, there would be a cooling effect.
Q. Okay. Now are you certain about your temperature measurements in this case?
A. We would now be referring --
Which case?
Q. To any of the -- all the temperature measurements you took in this case.
A. Well the instrument, my thermocouple has -- has a approximately plus or minus one degree basic error band associated with it.
Q. But there's something called common sense; correct? Engineering common sense.
Sometimes your instruments read something, you're like, that just can't be right. Did that ever happen to you before?
A. I -- Certainly, but I don't know what relevance that has.
Q. I'll get there in a second. But you -- That's happened to you before; correct?

A. If you're asking whether I've ever seen a screwy instrument reading, I've seen a lot of them.
Q. I mean, like, do you have --
Do you have kids?
A. Two daughters.
Q. You ever take a temperature of a kid and the thermometer says, like, it's 106 point something, you're like, this can't be right, let me check it again?
A. I never did that.
Q. Huh? Never happened to you?
A. No.
Q. If I took the temperature in here and it came out to be, like, 105 degrees Fahrenheit we'd say, something's wrong with that thermometer; correct?
A. I've already agreed --
I've already answered that question.
Q. Okay. Okay. So it's your understanding that the air coming out of the blower's 43 degrees Celsius, and you measure the air coming out of the jets at 32 to 33 degrees Celsius. Did you not think about this for a second and what that means?
A. Sure, I thought about it.
MR. GOSS: Objection, vague.
Q. What did you come up with?

A. There's heat transfer from the blower where the 43 degrees Centigrade is measured, all along the hose and the blanket. There's heat transfer from the blanket, probably by conduction to the skin, as well as by convection through these pores. So the 32 to 33 degrees that I measured does not surprise me.
Q. Okay. So you stand by that number.
A. I do.
Q. And that number is as accurate as the rest of the numbers in your report.
A. Well let me speak to accuracy, if I may. I usually -- One thing I do is use symbol size to indicate accuracy, and you notice that I haven't used tiny little symbols to give an impression of high accuracy. I went back to a zero on the horizontal axis -- we're looking at Figure 9 -- zero on the horizontal axis and remeasured it a couple times so you can see the group of three measurements up there, and that's probably experimental error there. So I -- I would stand by the shape of this curve, the intercept with the vertical axis being in the vicinity of 32 to 33 Centigrade, and I would certainly stand by the fact this graph shows the air temperature dropping off to within one degree of room temperature within about 60 millimeters.

Q. Okay. By the way, was the downflow generator on when you measured this?
A. No. This measurement was done just with a blanket on a benchtop, no downflow generator.
Q. Okay. All right. Now is it possible -- Withdraw that.
So there was no downward airflow that would affect this temperature at all.
A. Please take a look at Figure 8 b, and what you're seeing here is the blanket is horizontal, the jets are upward, and there was no downflow. This was a benchtop experiment, not an experiment in the --
Q. Okay.
A. -- in the rig.
Q. And the ambient temperature at that time was what?
A. That's indicated on Figure 9 as 22 Celsius.
Q. Twenty-two Celsius.
Why is the ambient temperature so much higher than the other -- other results, other ambient temperatures?
A. It was a hot summer's evening when this test was done.
Q. Okay. In -- In May?
A. This test was done --

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Q. Either April or May.
A. It was in May.
Q. So it wasn't summer yet.
A. Well, all right. Hot spring evening.
Q. Okay. And you stand by the accuracy of these numbers as much as you stand by all the other data points that you have in your report; correct?
MR. GOSS: Object to form, vague.
A. I think you've already asked me that and I've answered it, that I have confidence in these data shown on the graph in Figure 9.
Q. I'm saying based on your -- I mean you have -- you have confidence in all the temperature settings -- or temperature measurements you've done in your report; correct?
A. I do.
Q. That they're accurate; correct?
A. Well you have to define what "accurate" is. There's always an error bar, but within that definition I believe that these measures --
Q. I'll give you plus or minus two degrees.
MR. GOSS: You can testify to what your confidence level is in the temperature. I think that's what he's asking you.
A. Plus or minus two degrees.

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Q. Yeah.
A. I think it's reasonable.
Q. And same with the numbers you've taken on Figure 12; correct?
A. Let me look at that. These two were two different experiments, they're -- and done with two different instruments. On these, due to -- due to some differences that -- all right, that I'll explain to you that in the case of Figure 9 I had the thermocouple on a -- on a lab stand with a drive so that I could position it accurately. So I have a better confidence in the position of the -- of the temperature in that case than I do in these Figures 12 and 13, which were handheld. Handheld of course there can be some motion.
Q. Okay.
A. So there is a difference, but other than that I think the accuracies are similar.
Q. Okay. Let's assume that the air -- the air jets were between 41 to 43 degrees Celsius.
A. That's not what the measurement shows.
Q. I understand that, but I'm asking you to make an assumption.
Do you believe that would change the results of your testing?

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MR. GOSS: Objection, calls for speculation, improper hypothetical.
A. I don't know what results you're referring to.
Q. Well if you have air coming out of the jets at 41 to 43 degrees Celsius, you agree that it contains more energy that will affect the environment than air coming out of the jets between 32 to 33 degrees Celsius. Do you agree with that?
MR. GOSS: Same objections.
A. It's hotter, but I have to point out that the air jets coming out of the Bair Hugger could not be 43 degrees, that's the setting of the blower which is located a distance away with a hose in between, and it's already been discussed that there is heat tra -- heat loss all along the hose, and could be conduction loss from the Bair Hugger blanket directly to the skin which would reduce the temperature further in the plenum inside the Bair -- blanket. So I don't see a discrepancy here between my measured 32 or 33 degrees at the jet exit and the 43 degrees that is generated at the -- the Bair Hugger blower.
Q. Okay. So just so I understand you, you believe there's conduction -- a transfer of heat by conduction between the Bair Hugger blanket and the

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patient.
A. I think it's possible. The Bair Hugger blanket is in contact with the patient. There's heating by airflow through the holes, but there may be cases where the holes are occluded and the plastic is against the skin, and in that case you could have conductive heat transfer as well.
Q. Okay. So you're saying within one millime --
What do you think the temperature of the actual Bair Hugger blanket is?
A. You mean the internal temperature.
Q. Internal or external. The external that's touching -- that's outside that's not on a hole.
A. Well my measurement is essentially right over the hole. Now I did not measure the temperature, so you're asking me to speculate. I did not measure the temperature of the surface of the blanket, but -- so I'm really not supposed to speculate.
Q. Well let's go back from...
I mean the first thing you're doing is like -- to have a good scientific study you have to have a proper understanding of how the system works; correct?
A. What system?
Q. Like in the Bair Hugger. To do a proper

study on the Bair Hugger device you should know how the Bair Hugger works; correct?
A. Yes.
Q. Okay. And does it make sense to you, as an engineer, that if you're trying to maintain normothermia of 36 degrees Celsius that you have air jets coming out between 32 to 33 degrees Celsius? Does that make engineering sense to you?
A. It could make engineering sense if you also took into account the conductive heat transfer in cases -- in locations where the blanket is touching the skin.
Q. Well if that's the case you're just looking at conduction heat transfer, wouldn't it have been better just to like put the holes facing up instead of down so you don't get any of the cooling effect?
A. I --
MR. GOSS: Object to form.
A. What I'm suggesting here is that the Bair Hugger blanket may be not purely forced-air heating, but part forced air by jets and part conductive.
Q. Okay. I agree with that actually. I agree with that 100 percent.
But if you're going to do warming by forced-air warm -- forced air convection, forced-air

warming, the air coming out of the blanket has to be warmer than the patient or it would not do what it's supposed to do. Do you agree?
MR. GOSS: I'm just going to object that we're not offering him for any opinions on heat transfer or normothermia.
If you understand the question, you can answer it.
Q. We're talking straight engineering here, doctor.
A. My answer to that is that the Bair Hugger is described as a forced-air patient-warming blanket, but as we just discussed, may be part forced air and part conduction, and therefore the temperature of the jets coming out the hole is not the only thing that determines the heat transfer and the temperature rise that the blanket causes.
Q. Question. You agree with me that blowing 43 degree Celsius air on a 36 degree body is going to cause a cooling effect on that body; correct?
MR. GOSS: Same objections; calls for speculation, lack of foundation, outside the scope of his opinions.
Q. I assume you understand the second law of thermodynamics; correct?

A. I didn't answer your --
You've now two questions.
Q. Okay.
A. Which one do you want me to answer?
Q. Let's answer the second one.
You understand the second law of thermodynamics; correct?
A. I think so.
Q. And that this is straight up heat transfer, correct, enthalpy goes from a higher -- from a hotter device to a colder device or material; correct?
A. You shouldn't be using the second law to talk about heat transfer, you should be using the conduction, convection, radiation laws of heat transfer, in my opinion.
Q. Okay. Let's talk --
Which laws, the conduction?
A. Conduction, convection and radiation laws of heat transfer.
Q. Okay. If you blow 43 degree air -- or sorry, forty -- or 33 degree air, we'll take the higher number of your numbers, on a 36 degree patient, it would be a cooling effect. Do you agree?
A. Purely doing --
MR. GOSS: Same objections.

A. Purely due to the air jets that would seem to be the case.
Q. Okay. And -- And you were provided no studies from 3M which they conducted of the temperature underneath the Bair Hugger blanket when they've measured it, were you?
A. I'm not aware of such studies.
Q. Okay. Now if the temperature's coming out at, say, 41 degrees Celsius, just make that assumption, the jets are putting out 41 degree Celsius air, okay?
A. All right.
Q. Would that affect the results of your testing?
MR. GOSS: Objection, calls for speculation.
A. Which results would you be referring to?
Q. Would it -- Would it change the -- the schlieren imaging for Figure 10 a?
MR. GOSS: Same objection.
A. In order to see if I understand your question: If the temperature, instead of 33 were 41, would it change the results in Figure 10.
Q. a.
A. 10 a.

I don't think I'm able to give a definitive answer without doing that experiment.
Q. Okay. So sitting here today you don't know one way or another whether or not increasing the temperature by about 25 percent would have an effect on the schlieren imaging in figure a.
A. Well remember that it's the temperature of the jets that you're referring to, and what you're looking at here is the thermal effect or the thermal boundary layer on top of the Bair Hugger blanket, a cotton blanket, and a drape. So it's -- what you're asking me to speculate on is more complicated than the question would seem to imply.
Q. Okay. So sitting here today you can't answer that question.
A. No.
Q. Okay. Now going back to that picture, you're -- did you do any schlieren -- Hold on.
Go to page 4 of your report.
A. Yes.
Q. The image of Figure 10 a is basically where you have the schlieren mirror right above the patient as shown in like the top circle there; correct? In Figure 1.
A. That is correct.

Q. Did you do any imaging with use of the schlieren mirror like the one that's in the middle? Like where the middle circle is. Do you know what I'm asking you?
A. I understand. I understand.
Give me a moment, please.
Q. And if you need to refer to the hundred and some pictures that weren't produced, feel free.
MR. GOSS: Are you going to show him any pictures?
MR. ASSAAD: I don't have them, but I'm sure you do.
MR. GOSS: You got at least 80-some odd, last I checked.
A. In order to answer that question I'd go back and study the logbook and my notations on what we did. The intention was to do all three of those circles shown in Figure 1.
Q. Okay.
A. Whether we actually got there or not -- I know, for example, the lower one we tried and unfortunately didn't get a useful result in that instance. I am unsure about the circle in the middle. I would have to check before I could give you a definitive answer on the -- basically looking at the

side of the mannequin. So I'm -- I can't give a definitive answer right now.
Q. Okay. And the purpose of doing the side -- the intermediate was to check on what's going on on the side of the operating room table; correct?
A. Yes.
Q. Okay. Let's go to Figure 13.
A. Which? Yeah, Figure 13 of my --
Q. Figure 13 in Exhibit 2.
A. -- report. Figure 13.
Figure 13.
Q. Now you measured temperatures underneath the operating room table of 28 degrees -- between 26 to 28 degrees; correct?
A. 26, 28, 27, correct.
Q. Okay. And this was done on the 15th, you said, of May?
A. Let me check, please. That's on page -- page 18 of my logbook is where you see that, so that's May 15th.
Q. Okay. And where were these measurements taken, like where underneath the table?
A. These measurements were underneath the arm-board.
Q. Underneath the arm-board.

A. Yes.
Q. Okay. Now --
A. Because --
Q. Okay. Go ahead. I'm sorry.
A. If you looked at this from the top, there is no -- there's nothing if you move toward the torso and the leg, so these measurements have to be under the arm-board.
Q. Okay. And how far --
Did the drapes touch the floor?
A. No.
Q. Okay. Then I'm a little bit confused, before I get to the next question. If you go to page 12 of Exhibit 1, not Exhibit 2, Exhibit 1.
A. This one [indicating].
Q. Yes. I see something touching the floor there, I don't know what that is. Is that a drape or is that some other type of -- Exhibit -- Figure 11, Exhibit -- Figure -- Exhibit -- Figure 11 a of Exhibit 1. Are those drapes next to the feet of the person?
A. Yes.
Q. And it looks like they're touching the floor; correct?
A. In that case, yes.
Q. Okay. So you changed the drape style

throughout the experiment?
MR. GOSS: Object to form.
A. "Drape style."
Q. Like -- Like the drapes --
I mean here you have the drapes going, if you look at Figure 12, about halfway -- a little less than halfway between the top of the table and the floor; correct?
A. Figure 12 is a figure that I drew based on observation of the experiment, and so although there -- it's not accurate to scale, that drape does not touch the floor.
Q. But Figure 11 a's drape does.
A. It appears to, but Figure 11 a was subsequently removed.
Q. I get that, but this is what was submitted June 2nd to us.
A. Yeah.
Q. And it's something that we're going to be bringing up to the court that indicates that you did a revised report, and that the reason why it was part of your report was unreliable, which is Figure 11 a; correct?
MR. GOSS: All right. Object to form, object to the commentary. Move to strike. You can

ask him a question.
MR. ASSAAD: Okay.
Q. Who put the drapes on in Figure 11 a?
A. My assistants.
Q. Okay. Why --
Why do they look different than what's in Figure 12 and 13, to be quite honest?
A. Well what you're seeing in 13 is the drape over the body and the arm-boards, and I did not even depict which -- I might have, but I did not depict the drape over the body in that case. So Figure 13 doesn't pertain.
But in the case of your question regarding Figures 12 and Figure 11 a, I don't have an explanation for the discrepancy.
Q. Okay. Well is it in your notes?
A. You'll have to give me a moment to check. (Witness reviewing exhibits.) Figure 11 that was subsequently removed was one of the very last things that we did May 18th. I'm trying to find the date corresponding to Figure 12 because -- since that's not annotated with an image number, it's -- I'm going to have to find the notation where I took those measurements. So if you'll bear with me, please.
Here we go. May 15. I don't see an

explanation in the logbook for a difference in the position of the drape with respect to the floor.
Q. Okay. And by the way, was -- was the airflow -- the downflow generator on or off for Figure 11 a?
A. Well that was the discrepancy that caused it to be removed. My impression when we did the test was the downflow generator was on. It wouldn't make sense to do the test without it. However, the logbook says it was off, and this causes -- casts doubt on the figure, and that's why I removed it.
Q. Okay. Did you look at the videos?
A. Yes.
Q. Did you notice that it -- that the -- there was some sort of air current coming from underneath the drape?
A. Well I don't know if you have the video or not, but that video shows very little except thermal boundary layer on the leg and feet of the person who is wearing doctor's garb.
Q. I understand that, but do you -- did you notice that the drape had some airflow coming from underneath of it?
A. No.
Q. Okay. By the way let's go to -- let's go to

Figure 11 b. What is your understanding of how the anesthesia drape is supposed to be placed over a patient?
A. Once again anesthesia drape we built a frame to the dimensions that we had gotten, I guess by looking at examples that we found. I'm not sure -- I'm not supposed to guess here, but I'm not sure exactly where the height of that comes from. The -- Underneath that drape is a frame that holds it up, the drape is draped over the top in order to protect the face of the patient and isolate the anesthesia area.
I don't really understand what you're asking me here.
Q. It's your experiment; correct?
A. Yes.
Q. So how did you set up the drapes? That's my simple question, sir.
A. So as you can see in this picture, the drape -- there's a -- you can't see the frame, but there is a frame.
Q. Okay.
A. The drape is draped over the top of the frame and is open in the forward -- in the right-hand direction and then the drape tapers down to the body just out of the frame on the left.

Q. How far does it taper down; to the knee?
A. No. Probably to the midriff.
Q. Okay. And is that the head right there that you see in the picture?
A. I think so, yes.
Q. And that's the Bair Hugger blanket with a blanket on top of it? The white?
A. Bair Hugger --
The caption says Bair Hugger 522 blanket.
Q. Okay. Is there a drape over that blanket?
A. Yes.
Q. Okay. And then so there's another drape for the anesthesia drape; correct?
A. That's right. That was the body drape, not the -- the arms drape.
Q. There's a difference between a body drape and an arms drape?
A. Yes.
Q. What are the differences?
A. Look at Figure 12 and you will see -- well what's in white, Bair Hugger covered by a cotton blanket, but then in Figure 13 there is a drape over the Bair Hugger that extends all the way out to the ends of the arm-board.
Q. And that's a diff --

A. That's a separate drape from the one that covers from the chest down to the ankles in Figure 12.
Q. Do you remember earlier in this deposition I asked you how many drapes were in use and you said "one"?
Are you -- Are you correcting that right now?
A. I'm correcting that.
Q. Okay. Now there's two drapes used; correct?
A. Arms and body, yes.
Q. And that's for all the experiments that used the Bair Hugger.
MR. GOSS: Object to form.
A. Not all the experiments [clearing throat] that used the Bair Hugger were with arms out.
Q. Okay. All the experiments with the arms out had two drapes.
A. Two drapes.
Q. And you're confident about that.
A. Yes.
Q. If I call in your assistant and take her deposition, which I may do, she will testify or he will testify to that effect?
A. I believe she will.
Q. Okay. Is there anywhere in your notes that

says you used two drapes?
A. I'd have to check. [Witness reviewing exhibit.]
Q. You know, I withdraw that question. I'm not going to waste time. Your notes speak for themselves.
Were the drapes the same size?
A. No, because they're -- they drape different parts of the body, so they couldn't be the same size.
Q. But you didn't bother to take down the model number of the drapes?
A. I have it. I -- Whether or not it's written in my notebook, we have that information. We have the drapes.
Q. You've written reports before in scientific literature; correct?
A. I have.
Q. And we discussed this, that to do a -- actually you've even commented on Elghobashi as that his report is -- is publishable the way it's set up; correct?
MR. GOSS: Object to form.
A. You're referring to what when you --
Q. Have you said that or not?
A. I remember the word "publishable." So I used that word in my notes in looking at Elghobashi's

paper because of the elaborate model that he built and so forth, and the LES computation, before I discovered that Elghobashi had a serious discrepancy in his boundary condition that was unreasonable.
Q. Okay.
A. That part's not publishable.
Q. Assume that's correct. The reason why you could determine that is because he put his paper in a publication-quality format; correct?
Correct?
A. It had the appearance of --
Q. Okay.
A. -- a publication quality.
Q. You might disagree with the boundary conditions, but at least you could determine what the boundary conditions were; correct?
A. Not totally correct.
Q. You didn't know what --
You're criticizing his boundary conditions because of what he stated, and now you're saying that it wasn't in his report?
A. Well I'm referring now to his transcript of his deposition when he was unable to explain exactly how he had stated the boundary condition at the bottom of the drape, and he had no information about it

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except that he said he got it from a YouTube video.
Q. No. That's not exactly what he said, but I'll let you believe that.
A. Or words to that effect.
Q. But at the beginning of the time you said it was publication quality because it had the equations he used and it had enough information that someone could critique it or even reproduce it; correct?
A. At the beginning, before I saw -- found this boundary-condition discrepancy that was my impression.
Q. And you wrote that on page 9 of your -- in your notes; correct?
A. One moment. (Witness reviewing exhibit.)
Okay. Page 9. Right. The top of page 9 are my notes upon reading Elghobashi's expert report.
Q. Let me read that to you. It says: "Elghobashi did not simulate the HotDog," exclamation point; correct?
A. Correct.
Q. Then you say squames -- "squames" --
A. "Motion."
Q. -- "motion from floor to" operate -- "operating site. We cannot simulate this, nor turbulence levels."
You agree with that; correct?

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A. Yes.
Q. Okay. So your -- your report does not try to simulate squame movement in an operating room environment; correct?
A. It was not --
Q. Okay.
A. -- considered in my work.
Q. Then you said, "publication-quality," exclamation point; correct?
A. That's right.
Q. Okay. And you agree that the reason why you felt it was publication quality is because it had a methodology and someone could actually reproduce it or even question it based on the amount of information that was in there; correct?
A. That's not exac --
MR. GOSS: I think he answered that, but okay, try again.
A. That's not exactly the reason. It had the -- It was --
As you already said, it had the appearance of publication, it was put in the -- that format. It had publication-quality figures showing his results, and my initial impression of it was very positive.
Q. Okay. Now let's talk about your report.

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A. All right.
Q. Is a scientist in the field of doing what you do able to reproduce your report?
A. I think so.
Q. Okay. So if they ask --
So is there anything about how long the Bair Hugger is on in your report?
Not in your notes, in your report, sir.
A. It says Bair Hugger set at 43 degrees, and that means that you have to wait until the thing heats up, which takes sometimes minutes, 5, 10 minutes. So that's an indication of how long it's on. Once it's at 43 degrees we observed steady-state behavior.
Q. Okay. So your -- you make the assumption that when the dial says 43 degrees, that -- that you're at steady state.
MR. GOSS: Object to form.
Q. If The LED says 43, you're at steady state. You're making that assumption.
MR. GOSS: Object to form, mischaracterizes his testimony.
A. Now I'll -- to answer your question I'll repeat what I said before. I was also watching the schlieren image to see if I saw anything changing.
Q. Answer my question, please, sir.

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A. That is my answer to your question.
Q. So the dial -- the LED display says 43 degrees. Is that when you believe the Bair Hugger is at steady state?
A. That is when I believe --
MR. GOSS: Asked and answered.
A. -- it's at steady state.
Q. Okay. Thank you.
Now, but you don't mention how much time you have that you let the Bair Hugger run before you take any testing results; correct?
A. Correct.
Q. You understand --
You understand differential equations; correct?
A. Yes.
Q. Okay. And you understand the Navier-Stokes equations are differential equations; correct?
A. They are.
Q. And things change over time; correct?
A. Excuse me, but the connection between differential equations and whether you have a steady or an unsteady flow is -- is broken in that question.
Q. Do you believe --
A. I don't --

Q. Do you believe that an operating room is a steady or transient flow?
A. There's no simple answer to that, but I'll give you the best answer I can give. If people are standing still, okay, the downflow generator is steady in the mean, the outflow through the vents are steady in the mean, in the average, so that can be modeled as a steady-state mean flow. But of course turbulence can never be considered steady state because of motion of vortices and such. That's the best answer I can give you.
Q. So you ran a steady-state flow but you agree with me that an operating room, since it has turbulence, cannot be steady state.
A. Well we had --
MR. GOSS: Object to form.
A. -- turbulence here, also.
Q. Okay. Now you agree with me that if I turn on a space heater in this room right now, that it takes time for it to become steady state; correct?
A. Yes.
Q. Okay. And you didn't perform any of those calculations to determine how much -- how long the Bair Hugger has to be on before it reached steady state; correct?

MR. GOSS: Just going to object. I think he already stated he hasn't done any calculations in this report.
Q. Correct?
Correct?
A. Repeat the question.
Q. You haven't done any calculations to determine how long the Bair Hugger has to be on to achieve steady state in your system; correct?
A. No calculation.
Q. And you have done no experiments to determine how long the Bair Hugger has to be on to -- to get to steady state.
A. We had the experimental observation that the Bair Hugger reached its temperature, and the LED indicator indicated so.
Q. Because you assumed when the LED indicator hit 43 it was at steady state.
MR. GOSS: Objection, mischaracterizes his testimony.
Q. Correct?
A. Yes.
Q. Okay. Now with respect to Figure Number 12, sir, how many temperature measurements did you take for each -- Figures 12 and 13 to compare whether or

not you were at steady state or -- or if things were still changing?
A. With the wand anemometer the response time is not very fast, so about all you can do with that is to hold it in a fixed position, allow the temperature to equilibrate and assume that it's a steady-state measurement.
Q. How long do you hold it in a fixed position?
A. Until the temperature equilibrated, which in this case would have been 30 seconds to a minute.
Q. Okay. So you stood still for 30 seconds to a minute without moving the anemometer in any direction.
A. For -- For each one of those points.
Q. Okay. And how long was the Bair Hugger on, from the -- when you took the first measurement?
A. Could you clarify whether -- "How long it was on." Since we flipped the switch?
Q. Yes, and it read 43 degrees Celsius.
A. Oh. I think I've already answered that question. I'm -- I remember answering that question.
Q. We talked about with respect to when you did the schlieren imaging. I'm talking about with Figures 12 and 13 when you did the temperature measurements, which was a different day.

A. So you're --
The question is how long after the Bair Hugger reached its equilibrium did I take these measurements.
Q. Yes.
A. There's --
It's a complex answer because the measurements take a long time, but I let the Bair Hugger reach its equilibrium temperature and did not start taking data immediately, but gave some time for any further equilibria -- equilibration that might be called for. I would say five or ten minutes.
Q. Okay. So -- So within 5 or 10 minutes you took down these five temperatures?
A. Right. No. It takes a long time because it takes a minute or two for each --
Q. Okay.
A. -- point, and then it takes time to reposition, and so forth.
Q. Okay. Which was the first temperature you took on page -- Figure 12?
A. I actually don't recall the order that those were taken in.
Q. Okay. You agree that according to Figure 13 that the area under the arm-board increased as a

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result of the Bair Hugger.
MR. GOSS: "The area under the arm-board"?
Q. The temperature -- The area --
The temperature under the arm-board increased. I'm sorry.
A. Yes.
Q. Okay. And that's as a result of the Bair Hugger turning on; correct?
A. Yes.
Q. I mean, if the Bair Hugger wasn't on it would be ambient temperature.
A. It would be, or close to it.
Q. There's no other heat source down there except the Bair Hugger; correct?
A. You are correct.
Q. So basically within 10 minutes the -- give or take plus or two minutes, the Bair Hugger went from 17 degrees -- or the air underneath the drape went from 17 degrees Celsius to 28 degrees Celsius; correct?
A. Well not correct, because what you're missing in that question is that the airflow is on from the moment you switch on the power of the Bair Hugger unit and it's flowing, but then the Bair Hugger takes time to reach its setpoint. So I think your

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question is implying that the airflow started when the Bair Hugger reached 43 degrees, and that's not the way it operates.
Q. I understand how a Bair Hugger operates.
But from the time --
I just want to know a simple question. From the time you turned on the Bair Hugger till you took the 28-degree Celsius measurement, how long was it?
A. And can you explain what you mean by "turned on the Bair Hugger"?
Q. Flipping the switch. That's all I need to know. Putting it on 43 degrees. There's a button that says ambient, 38 or whatever, 33, 38, 43, and then low and high.
I assume you put it on high; correct?
A. High. That's the fan setting.
Q. And you put the temperature to 43; correct?
A. Correct.
Q. And that automatically turns on the Bair Hugger when you hit 43.
A. No. The Bair Hugger's running and blowing air the whole time.
Q. So you were running the Bair Hugger without turning it on --
You had it on, but running on ambient?

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A. No. It's heating up. The 43 is the setpoint.
Q. Okay. Let's back up. Let's back up.
Let's just make it simple. You turn on the Bair Hugger to whatever setting you put it at, which was 43 degrees on high, okay, from the time you flip the switch and the motor starts rotating, okay?
A. Yes.
Q. From that point --
A. Yes.
Q. -- till you took this measurement of 28 degrees Celsius, how long was it?
A. Twenty minutes.
Q. Twenty minutes. Okay.
Is that a guess?
A. I'm not supposed to guess, but it was on the order of 20 minutes. It was not two minutes, it was not 200 minutes.
Q. Okay. So 20 minutes, give or take five minutes?
MR. GOSS: If you can put that boundary on it, go ahead. But if your answer is what it is, then you don't have to change it.
A. Twenty minutes, give or take 10 minutes.
Q. Okay. And we don't know which order you

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took these measurements in; correct?
A. We don't.
Q. But we have to guess that it's at least between -- one minute to two minutes between measurements.
A. Several minutes between measurements.
Q. Okay. Sitting here today you cannot give me an answer of how long the Bair Hugger was on before you started taking temperature measurements.
A. I just did.
Q. You took a --
It was a guess, plus or minus 10 minutes.
MR. GOSS: Well object to form. You've asked him to make estimates about things.
Q. Plus or minus 10 minutes; correct?
A. I've already answered that question, sir.
Q. Plus or minus 10 minutes. I'll take that. Okay.
How long do you think it takes for the Bair Hugger to -- in a room that nothing is changing, which is not the room that you have, but in a normal room, how long do you think it takes to get to steady state?
A. Once again the way you stated the question is ambiguous to me. What takes to get to steady state, the temperature of the blanket?

Q. The temperature underneath the blanket. The temperature underneath the drape.
A. I believe we -- that you and I still have a misunderstanding about that, that the -- when you turn the power unit on for the Bair Hugger the heating element and the fan both start operating, okay? And then it takes a long time for the Bair Hugger to heat up, 10 -- 10 minutes, 15 minutes.
Q. You think it takes 10 to 15 minutes for the Bair Hugger to get to 43 degrees Celsius?
A. It takes a long time.
Q. Is that your testimony today; 10 to 15 minutes for the Bair Hugger to reach 43?
A. From flipping the switch.
Q. You understand that you actually could see the temperature, it counts up when you turn on the Bair Hugger. You're aware of that; correct? The LED changes till it gets to the 43.
A. It's not that fast in the equipment we used.
Q. Do you think your equipment was faulty?
A. No. I had my technician operating the equipment, and he was waiting for the temperature to be reached, 43 degrees, before we took data, and it took time. It took minutes. It doesn't just come --
Q. Well now it's -- now it's minutes. Before

you said it was 10 to 15. Now it's minutes.
A. It's minutes.
MR. GOSS: Do you want him to guess or not?
MR. ASSAAD: I want him to know what he knows, which doesn't seem like --
A. I'm not going to guess.
Q. Well then don't guess, but here's the situation. I'm trying to reproduce this study, and I might go spend some money to reproduce it, and at this point in time I need to know when you took the measurements and how long after so I can compare my results to your results.
A. Umm-hmm.
Q. Okay. That's the point of a scientific study. You agree? Okay?
A. Comparison, yes.
Q. That I can reproduce it.
A. Yes.
Q. And right now you are giving me a bunch of guesses that I cannot say at what point in time after I turn on the Bair Hugger that I could take these measurements to get similar measurements to you. Isn't that fair?
MR. GOSS: Object to form.
A. Turn on the Bair Hugger unit and let it warm

up. When it reaches 43 degrees with now a few extra minutes to ensure equilibration, you can proceed.
Q. Okay.
A. What's the -- I don't see a difficulty there.
MR. GOSS: You've answered the question.
Q. And you didn't do any schlieren testing on this -- on -- with this -- with temperature measurements; correct?
A. These were without schlieren images.
Q. Okay. So how do you know, when you took the measurements, that you were at steady state?
A. As I've already stated, there was a time -- a time delay was built in for these measurements after the Bair Hugger reached its steady state --
Q. That's not a --
A. -- to make sure.
Q. -- scientific basis, sir.
Give me -- Give me an equation or an experiment or a basis.
If I put a heater in this room, okay, I will test it to see -- I could put a thermometer and it becomes steady state when the temperature doesn't change. Do you agree?
"Yes" or "no"?

MR. GOSS: Object to the form.
Q. Do you agree with that?
MR. GOSS: I believe he's answered the question.
A. Would you repeat the question?
Q. If I put a space heater in this room, according to the law of thermodynamics it's going to increase the temperature in this room if we keep everything constant; correct?
A. I'm sorry. The law of what?
Q. Thermodynamics, first law.
A. At steady state.
Q. It's going to take time to get to steady state, but it will increase; correct?
A. Yes.
Q. And when you get to steady state is where everything's at equilibrium and there's no --
(Interruption by the reporter.)
Q. When you get to steady state that's when everything's at equilibrium and you don't see a change in temperature; correct?
A. Correct.
Q. Okay. You did not do that in this case; did you, sir?
MR. GOSS: Object to form.

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A. Yes, I did.
Q. Where? Where's the data to show me the multiple temperature measurements to show that this is at steady state?
MR. GOSS: Objection, asked and answered.
MR. ASSAAD: Yeah, right.
A. Do you have a question for me?
Q. Yeah.
Show me the measurements that you determined that this 28 degrees, or 26, or any of these numbers on Figure 13 and Figure 12 were taken at steady state.
MR. GOSS: I believe you've testified to the measurements that you've taken. If you have a different answer, if there's more information, you can provide it.
MR. ASSAAD: And I ask Mr. Goss to stop coaching the witness.
MR. GOSS: There's nothing to coach.
Q. Show me the measurements.
A. As I've already testified, the -- one anemometer was held in a position until it reached steady state.
Q. No. You testified that you held the anemometer for a minute --
A. I believe I have testified that the

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anemometer is held in a position for one of these measurements until the reading reached steady state.
Q. How long did that take?
A. For these --
I already gave you that answer, too. That takes at least a minute, and perhaps several minutes.
Q. A minute for the anemometer to read the temperature; correct?
A. To reach an equilibrium value.
Q. Okay. So you think it takes one minute for each measurement.
MR. GOSS: Well, mischaracterizes. I think he said "at least."
A. To rephrase it. If the temperature were not steady state the anemometer would be showing measurements that never equilibrate.
Q. Okay. So your testimony is that you know it's at steady state because the anemometer came to an equilibrium in each of the measurements.
A. Within one or two minutes, yes.
Q. Within one or two minutes. Okay.
How fast or at what rate do you believe that the Bair Hugger changed the temperature underneath the -- for example, underneath the arm-board from 17 degrees Celsius to 28 degrees Celsius?

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A. I've already answered that question, sir.
Q. No, you haven't.
A. Yes, I have.
Q. Well answer it again, then.
A. See if I can repeat my answer.
The -- From flipping the switch, in our experience it took between -- on the order of 10 to 15 minutes for the Bair Hugger to reach its equilibrium temperature, and then a further amount of time was taken to ensure equilibration before measurements were taken.
Q. Where does that heat go that's underneath the arm-board?
A. Are you asking me where the warm air goes?
Q. Yes.
A. I didn't measure that specifically. I would have to speculate.
Q. You agree it doesn't get destroyed; correct?
A. We -- We destroyed no air, that I'm aware of, in this experiment.
Q. So it has --
A. Except maybe the candle flame.
Q. And it has to go somewhere; correct?
A. It has to go somewhere.
Q. And it has a buoyancy to it; correct?

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A. Yes.
Q. Because it's warmer than the ambient air; correct?
A. It is.
Q. Do you agree that when it -- if it's 28 degrees and it -- once it reaches the side of the drape that it's going to begin to go up because of buoyancy?
A. Well it's blocked on the sides by the drape, so I believe that a thermal boundary layer forms on the bottom of that arm-board and that it spills out at the location that is easiest, which would be right where the -- right here [indicating].
Q. Is that --
Is that towards me or further from me, like into the paper or out of the paper?
A. It would spill at the sides, towards you and in the other direction as well, because the drape hangs down the least there. And maybe -- All right. So let's put it this way.
Q. Can you please high -- or please highlight the area you're talking about on Exhibit --
Is that Exhibit 2?
A. Exhibit 1.
Q. Let's use Exhibit 2.

Can you highlight where you believe the air would escape?
A. (Witness complying.)
Q. All right. And can you -- on Figure number 7 -- 12 can you correspond to, like, the side-view of what you highlighted? Could you?
A. It's not really visible in that figure because the figure is kind of a perspective looking down on top of the table --
Q. Okay.
A. -- so I can't actually see under there.
Q. So you highlighted between like 26 and 27 degrees Celsius marks; correct?
A. The center.
Q. Okay. And that's going to --
And you want to keep that down so the camera could see the document.
MS. ZIMMERMAN: The camera over your shoulder is looking at it from above.
Q. And that would escape out into the atmosphere, is that your?
A. Well, I mean, all of this is you're asking me to speculate. But since I have to answer the question, that's my surmise.
Q. Okay. And the temperature of that air,

based on the points, are about 26 to 27 degrees Celsius?
A. Yeah. That's what the measurement shows.
Q. Okay. And therefore that air would rise; correct?
A. Correct.
MR. GOSS: I could use a bathroom break whenever you reach a good spot.
MR. ASSAAD: We can take a break now.
MR. GOSS: Okay.
THE REPORTER: Off the record, please.
(Recess taken from 4:13 to 4:19 p.m.)
BY MR. ASSAAD:
Q. Going back to Figure Numbers 12 and 13, Dr. Settles, you agree with me that if -- assuming that the air coming out of the jets is 41 degrees Celsius, that would affect the numbers -- the measurements that you had on Figures 12 and 13; correct?
MR. GOSS: Objection, improper hypothetical.
A. Would affect it as compared to what?
Q. As compared to what you have here.
A. In other words, compared to my measurement at the holes of 32, 33 degrees.
Q. I'm saying assuming --

A. Oh.
Q. -- that the air coming out of the holes is 41 degrees Celsius, you agree with me that it would affect the measurements that you've taken in Figures 12 and 13; correct?
MR. GOSS: Same objections.
A. I --
Sir, I have to call that an improperly formulated question. The measurements I've taken are what they are regardless of what the temperature is coming out of the holes.
Q. Say I had a Bair Hugger blanket that produced 41 degrees Celsius air coming out of the holes, the jet -- jets of air coming out of the holes. Would that change the temperature that -- the temperatures that you have listed in Figures 12 and 13?
A. I just answered that question.
MR. GOSS: Calls for speculation.
Q. So you're not going to answer the question?
A. The these are the numbers that I measured from the Bair Hugger blanket, I -- regardless of what the temperature was coming out of the holes.
Q. Well don't you think the temperatures coming out the holes are going to effect these temperatures

that you measured?
A. That's not what you asked me.
Q. Do you think that would affect what you're measuring?
A. If you changed it.
Q. Yes.
A. It would affect these -- these numbers.
Q. And if you increased --
A. But we didn't change it.
Q. Okay. I'm not asking you that, sir.
And if I -- if we changed the temperatures and increased the temperature coming out of the perforated holes in the Bair Hugger, would you agree with me that would increase these temperatures in Figures 12 and 13?
MR. GOSS: Same objection, improper hypothetical.
A. As you stated it this last time, yes.
Q. Okay. And in fact it would significantly increase the temperature if you changed the temperature coming out of the perforated holes from 33 degrees to 41 degrees Celsius; correct?
MR. GOSS: I'm just going to object that the 33-degree temperature is not in Figure 12 or 13. But subject to that, you can answer.

A. What's your question, please?
Q. Well let's back it up a little bit.
I would assume, and correct me if I'm wrong, doctor, that the measurements taken in Figures 12 and 13 was with the Bair Hugger on, and that if you measured the air coming out of the perforations it would be what you measured previously as being 33 degrees -- 33 or 32 degrees Celsius; correct?
A. There is a difference in the sense that in this case the -- the mannequin is draped, cloth over the top and so forth, whereas in -- as clearly stated in the report for Figure 9 I believe -- for Figure 9 and Figure 8 b, this was done as a benchtop experiment, it was not draped, it was not on a mannequin. It was the Bair Hugger blanket on a benchtop. It's not exactly the same situation.
Q. Okay. So what's the purpose of doing that measurement, then, if it does -- if it's not relevant to how it actually is used in an operating room?
A. I didn't say it wasn't relevant. I think it's very relevant, but --
Q. How is it relevant?
A. It's relevant because I'm isolating the microholes and I'm examining the behavior of the jets which I see are mixing out very rapidly, and I'm

making a -- measuring the temperature distribution.
Q. But your measure --
A. I think I claimed, I did claim, if you look in my report for Figure 9 --
Where can I find it?
Q. I'm aware of your report. I know you made the claim that this is not typically how it's used.
A. Yes.
Q. I understand that, sir.
A. I made that claim.
Q. I've read your report.
So my question is: Do you know what the temperatures coming out of the jets when it's placed above a patient as used in an -- as used as it's supposed to be used in an operating room?
A. I did not make that measurement.
Q. Okay. Do you think it will be more or less than 32 to 33 degrees?
A. You're asking me to guess.
Q. I'm ask -- If you know. I'm ask -- If you don't know, you can say "I don't know."
A. I don't know.
Q. Okay. I don't want you to guess, but it's okay to say "I don't know the answer."
A. Right.

Q. Now let's go to Figure 14. This is where you compare the convection currents between the Bair Hugger blower and the HotDog control device; correct?
A. That's correct.
Q. The HotDog is not a blower; correct?
A. It has a cooling fan but it is not a blower in the sense that -- same sense as the Bair Hugger.
Q. And if I look at figures b and d I see a significant difference between the -- the density of the air around the Bair Hugger as compared to the HotDog. Is that -- Is that an incorrect statement?
A. It is in the sense that you're looking at density gradient. But if you replaced "density" with "density gradient," in these particular pictures I would say yes.
Q. Okay. And you would consider them remarkable; correct?
A. My conclusion, from examining the images and the videos, is that the airflow patterns around the Bair Hugger blower and the HotDog power unit have differences that are not remarkable.
Q. And what's your basis that -- what's your definition of "remarkable"?
A. Significantly different, obviously different.

Q. So you're saying here between figures b and d you see no significant difference.
A. Remember I also talk about looking at the videos. And we know that single images don't convey the nature of something that's turbulent -- has turbulent convection and so forth.
Q. So if you look at videos 239 and 242, is that what you're referring --
(Interruption by the reporter.)
A. Yes. I think you'll get a better impression of the phenomenon.
Q. And 239 and 242 are the viewpoint of images a and c; correct? If you know.
A. I don't know --
Q. Okay.
A. -- without looking it up.
Q. And my understanding is -- Well let me ask you this. Strike that.
The determination of whether or not a change is remarkable or unremarkable is subjective; correct?
A. I don't -- I don't think that "subjective" is a good word, but I can -- you would have to ask a number of observers to look at these images and reach a consensus if you'd like a perfectly objective result.

Q. Well we can agree that schlieren imaging is quantitative, not qualitative. Doesn't give you a number.
A. No. You have these backwards.
Q. Or qualitative, not quantitative. I'm sorry.
A. In this instance we did qualitative schlieren visualization. We did not extract numbers from the schlieren images --
Q. Okay.
A. -- although it is possible.
Q. Now according to page 3 of your report, on the last line you write -- you're talking about you can't do a schlieren optical system in an OR because of the size constraints. It says: "Instead, the approach taken here is to experimentally reproduce a typical OR laminar downflow..."
A. Yes.
Q. Okay. And that was your goal; correct?
A. Well it was to isolate the laminar downflow, the surgical table, the mannequin with the blankets and examine the interaction of downflow and blankets in the same way between the forced air and the conduction blanket without going through a complete simulation of an operating room.

Q. Okay. And as we discussed previously, there are many things that could alter the laminar flow or the unidirectional flow in an operating room that's around the surgical table; correct?
MR. GOSS: Objection, vague.
A. Yes. Can you be more specific?
People moving around, is this what you're referring to?
Q. No. Just having four people around the operating room table, that's going to effect the unidirectional flow based on their thermal plumes; correct?
A. Compared to what, having no people?
Q. Yes.
A. People certainly make a difference, yes.
Q. Having a -- a patient there that -- has a -- that puts out wattage is going to have an effect on the unidirectional airflow; correct?
A. I think that's a negligible effect.
Q. Okay. But you could have put people in to your -- to your study, and you decided not to do that; correct?
A. That's correct.
MR. GOSS: Object to form.
Q. And probably the reason why is because it would probably block the schlieren mirrors.

A. Is there a question there for me?
Q. Yeah. That's -- One of the reasons why you didn't put people in there was because it would affect -- you probably would not get a direct image of the mirrors and it would obstruct the view.
MR. GOSS: I'm just going to object that it misstates the report with respect to Figure 15, but you can answer.
MR. ASSAAD: I'm not even on Figure 15.
MR. GOSS: Okay.
Q. Well you could use four people around the operating room table; correct?
A. You see people around the operating table in this figure.
Q. I see one.
Correct?
A. One person.
Q. You understand around a typical total hip or total knee arthroplasty there is the anesthesiologist; correct?
Correct?
A. Well we don't have to count these people. There are more -- There are several people around the surgery table.

Q. And not only are they going to have an effect causing, you know, thermal plumes, but they're also going to effect the airflow around the operating room table and especially underneath the operating room table; correct?
A. I don't know how much effect underneath, but they certainly interact with the laminar downflow as far as their upper body and head's concerned.
Q. So if you were to give me a percentage of similarity between your setup and a typical OR, what would you give?
MR. GOSS: Object to form.
A. I can't even make that estimate because, as we just discussed, this is a simulation of the center of the operating room with the downflow and its interaction with the immediate vicinity of the table. And we did have one person, we could have had four people, as you said. But give you a percentage? I don't even understand what you're asking me.
Q. Let me ask you this. Could you publish this report and come to the conclusion and state: In a typical operating room where a total hip or total knee arthroplasty was performed that the Bair Hugger has no effect on unidirectional airflow?
MR. GOSS: Object to form.

Q. Can you make that statement in a peer-reviewed literature based on the study that you performed?
A. If I published this I would not claim that this was an operating room, it was a simulation of the downflow and the patient on the table. We're not simulating an operating room.
Q. So you can't state today that your report claims that in a typical operating room the Bair Hugger would have no effect on the unidirectional airflow.
MR. GOSS: Object to form.
A. I didn't even claim that the Bair Hugger has no effect in the simulation, so I certainly wouldn't claim it in an operating room that I didn't simulate.
Q. So you do agree that the Bair Hugger has an effect on the downward airflow of, like -- the unidirectional airflow.
A. If you will please look at Figure 10, you will see that both the Bair Hugger and the HotDog have visible effects on the laminar downflow.
Q. Okay. And just -- And you -- and -- Strike that.
And you agree with me that you have no evidence to make the statement that the Bair Hugger

device has no effect on particle movement from particles underneath the operating room table.
A. My study didn't involve particle movement.
Q. Okay. So you're not going to make that claim at all and you have no evidence to either support or refute that claim.
MR. GOSS: With respect to particle movement under the OR table.
MR. ASSAAD: Yes.
A. We have no evidence of particle movement under the OR table.
Q. And you are not going to make the claim that the Bair Hugger does not form convection currents from underneath the operating room that could carry particles.
A. As we already know in this testimony, we didn't actually get any usable results underneath the operating table.
Q. Okay. Okay. So the only thing that you're claiming is the effect a Bair Hugger has, mainly by conduction, on the effect of the unidirectional downward airflow; correct?
MR. GOSS: Object that it --
A. Not correct.
MR. GOSS: -- misstates his testimony and

opinions.
MR. ASSAAD: I'm trying to understand his testimony.
Q. The buoyancy or the density difference that you see in Figure 10 a, that's a result of the heat transfer from the Bair Hugger through the cotton blanket and through the drape and then exited above the patient; correct?
A. Yes.
Q. And the transfer of the Bair Hugger from the Bair Hugger blanket to the blank -- to the cotton blanket, would you agree with me is mostly by conduction?
MR. GOSS: Calls for speculation. You can answer if you have an understanding of that.
Q. I can make it easier.
You agree with me that the jets are pointing downwards and what's up top is a smooth surface, correct, that's in touch with the blanket, cotton blanket; correct?
A. All right. That's the way the blanket's supposed to be applied, yes.
Q. Okay. Therefore it's by contact that the heat's being transferred from the Bair Hugger blanket to the cotton blanket; correct?

A. Yes.
Q. And I'm not saying it's a hundred percent conduction, but we could agree based on engineering principles, education, training and experience that the primary source of heat transfer is by conduction from the Bair Hugger blanket to the cotton blanket. Do you agree?
A. I agree.
Q. And also for the same as from the Bair Hugger from the cotton blanket to the surgical drape; correct?
A. Correct.
Q. Because the surgical drape is impermeable, so even if there's air flowing through it the way it's going to effect the schlieren imaging is because of the conduction of the heat transfer from the cotton blanket to the surgical drape; correct?
A. Correct if you add that what we see in the schlieren imaging is the convection rising from that.
Q. Oh yeah. And that's the -- that's the natural convection from a heated surface into air.
A. Yes.
Q. Has nothing to do with the convection from the jets coming from below.
MR. GOSS: Object to form.

A. I can't agree with that positively because I don't know how much of the jet air manages to make it around and come up above.
Q. But even if -- above from around the blanket?
A. I don't know how much that may happen.
Q. So that may happen that the heat can come from around the blanket up into the -- into the -- above -- above the patient. Just so I understand you correctly.
A. The way we've set it up I agreed with you already that it was primarily conduction.
Q. Conduction.
A. Conduction.
Q. Okay. But -- But --
But there may be some convective currents that come from the jets that escape from the side of the drape and shoot up and cause some of this refractive density, I think that's the right term, in the schlieren imaging; correct? In Figure 10.
A. I wouldn't rule it out.
Q. You wouldn't rule it out.
A. No.
Q. Okay. And you agree if some of this convective -- some of the airflow that comes from

below the Bair Hugger that actually comes from underneath the table and rises along the sides above the operating room table, that may carry particles with it from underneath the operating room table; correct?
MR. GOSS: Objection, beyond the scope of the opinions.
A. I'm really not going to comment on particle motion here.
Q. Well you agree that air contains particles; correct?
A. Not always.
Q. Well unless it's particle-free air. But you could agree with me that with -- I mean you -- you cite ASHRAE; correct? In your references; correct?
A. Yes.
Q. And you agree with ASHRAE when they say between 1 to 900 million skin squames are shed during a typical surgery.
A. That number in the literature is -- varies very widely, but I would agree with you that a large number of skin squames are released by the human body.
Q. And this air that's escaping from underneath the Bair Hugger and rising may carry some of those skin squames up; correct?

A. I don't --
I'm not aware that there is air escaping from underneath the Bair Hugger and rising because the drape, as you pointed out, is impermeable, so.
Q. But you just said you wouldn't rule it out, though.
MR. GOSS: This is getting speculative, but if you have a different answer than you provided, then you may answer.
Q. Well you mention -- you testified before you wouldn't rule that out.
A. I testified that I think that it's -- would be a minor effect, or I would like to say that if that's there it's a very minor effect.
Q. So you -- your testing did not rule that possible effect out; correct?
A. My testing did not.
Q. Okay. So explain to me, you did testing one day and you threw it all out because there was a problem?
A. Would you be referring --
What would you be referring --
Q. The stratification issue, page 15.
A. Yes. That was already discussed, I think, or was it?

Q. I don't believe it was.
A. All right.
Q. But I'm sure if it was your counselor would say, "asked and answered."
MR. GOSS: That's true.
Q. So since he's being quiet I assume that it hasn't been discussed yet.
A. All right. That is what happened. We had, on that particular day because of a severe rainstorm we had a set of problems that I deemed to be serious enough that we would repeat those tests, and we did repeat those tests subsequently. This is my duty and responsibility not to accept conditions that are not acceptable.
Q. Did --
Would it be fair to assume, since there was -- this was an open-air facility that had no ventilation -- heating or ventilation, air conditioning, that --
A. It had natural ventilation.
Q. And the natural ventilation is based on the outside temperature; correct?
A. It's a --
It's affected by the outside temperature, sure.

Q. So you would agree with me that throughout the day the temperature would be different in the warehouse.
A. There were some temperature variations which we measured and recorded.
Q. I mean, some days it changed by four or five degrees; correct?
A. Yeah. It could.
Q. And of course you agree that that's going to have an effect on comparing test results from one day to the next.
A. I don't think the four or five degrees is that significant.
Q. Okay.
MR. ASSAAD: By the way, Peter Goss, we withdraw our request for any other images --
MR. GOSS: Okay.
MR. ASSAAD: -- that were not produced.
BY MR. ASSAAD:
Q. And Mr. Settles, I think I understood this before, just wanted to clarify.
There was an issue of trying to get an average of a 39 feet per second or per minute face velocity with your downflow generator; correct?
A. We spent several days on this of hard work

trying to get it as good as we could.
Q. Okay. Did you ever consider just --
Well would you agree that one of the issues that caused problems was because you were feeding the air from the side instead of from a duct up top?
A. That's a good question.
Q. At least you think one of my questions is good today.
(Laughter.)
A. I've cited reference 22, Richardson's paper on how to design a fluid flow distributor. And basically that paper says that if the distributor's designed correctly, then every orifice or every segment has the same pressure drop. In that case it doesn't matter what the airflow pattern is inside the plenum because the flow rate will be the same if the pressure drop is the same and the outside pressure is the same.
Q. But you couldn't achieve that; could you?
A. We didn't exactly achieve that, no.
Q. Okay. And it --
A. We tried.
Q. And it's obvious from probably the first -- from pages 7 to 11 about the different types of testing and throttle positions and stuff you put

inside there to get to a 39 foot per minute face value -- face velocity; correct?
A. You now are referring to the logbook.
Q. Yeah, Exhibit 7.
A. Pages 7 to 11.
From -- To page 11. You'll see on page 11 that that's where we began taking data on April 27th.
Q. And you picked what's called --
A. "Chosen operating conditions."
Q. And used marked, quote unquote, 41; correct?
A. That's right.
Q. And for that chosen operating condition the face velocity was 41 feet per minute; correct?
A. Average.
Q. Average.
And you've never made any changes with respect to the throttle since that day; correct?
A. I believe that the throttle setting of 17 was then constant because you see it again on May 5th.
Q. And you agree that even with the throttle setting of 17, depending on the day, the face velocity could -- was changing.
A. The measured -- The measurement changed.
Q. Okay. Now I'm trying to understand this on the side of page 11 it says "need 150 millimeter," I

don't understand that. "Outward" or out --
A. Need 150 millimeter outboard focusing lens plus options. Plus or minus options. That refers to the fact that with this schlieren -- I'll try to keep this concise -- with this schlieren system a normal camera lens doesn't function because it vignettes or crops the image. And this was my -- my purview as the optics guy to try to fix this, and my solution to it was to take off the camera lens and put an outboard fixed lens in place. Unfortunately the first one I used didn't have exactly the right focal length, so this is my note to myself that I needed a different lens in order to fit the circle on the digital image plane properly.
I realize that without an explanation that doesn't make sense to anybody.
Q. All right. Let's go to page 21.
A. Okay.
Q. Under "downflow generator off," see that big square there?
A. Yes.
Q. It says, outside temperature approximately one degree Fahrenheit greater than indoor temperature, therefore downflow is subject to buoyancy and relevant temperature is an issue.

Did I read that correctly?
A. You did. "Relative" temperature.
Q. "Relative."
What do you mean by that?
A. We had to be careful not to feed the downflow generator with air at a different temperature than the room air, because in that case the air that comes out of the downflow generator will be subject to buoyancy forces. And in most of the testing the temperature was the same, but in this and the case noted earlier that was repeated, we had some difficulty.
Q. Well would you agree with me that in an operating room the temperature from the air supply is at a different temperature than the operating room?
A. Colder, yes.
Q. Okay. So there'll be some buoyancy forces with re -- with respect to buoyancy from heat sources on that air that would be different than if the temperature's uniform; correct?
A. I'm sorry. Can you rephrase?
Q. Well the fact that there's a different temperature from the air supply in an operating room has an effect on buoyancy as well; correct?
A. Buoyancy of what?

Q. Of the Bair Hugger device, the -- the -- the heat sources, such as the people in the room.
A. All right. I'm trying to -- I'm trying to get a question from you that I can answer.
Q. Okay. Well let me -- let me --
We could agree that the operating room air supply is at a different temperature than the operating room; correct?
A. I think we already discussed that it's colder for --
Q. Okay. And that wasn't the case in your simulation; correct? It was all one constant temperature; correct?
A. We -- Yes.
Q. Okay. And with respect to buoyancy, the Delta T has an effect on buoyancy; correct?
A. Buoyancy of what?
Q. Of air.
A. All right. I'll try to answer that question as I understand. Buoyancy of, let's say the -- the plume of the candle, a candle flame, --
Q. Yes.
A. -- which is buoyant? All right.
It's a one degree difference so it'll have a minor effect.

Q. What if it's a six degree difference?
A. Once again I'd do this calculation, but certainly if you have a vast difference in temperature of the downflow then you would see a difference, yes.
Q. Okay. And do you know what the temperature is around where the surgeons are standing and the patient is in an operating room if the air coming out is about 59 degrees Celsius?
A. Well I've seen numbers that are -- that vary from one operating room to the next, so I don't know that there's an exact answer to that.
Q. Do you know the rough Delta, Delta T between what's coming out of the ceiling and what's around?
A. A few degrees.
Q. Few degrees? Okay.
And you agree that a few degrees will have an effect, you just don't know whether or not it would be a significant effect or not.
A. I'll agree with that.
Q. Okay. Is there anywhere in any of the plaintiffs' expert reports that say the jets that are coming out of the Bair Hugger blanket reach the operating room floor?
A. My understanding of the reports cited by the plaintiff are that a stream of air reaches the

operating room floor, not the jets from the individual holes in the Bair Hugger blanket.
Q. You agree that --
You agree that the drape is impermeable; correct?
A. Yes.
Q. As we discussed.
And if the drape is coming around the entire table, okay, including the feet, and air can escape, that the mass flow of air coming in underneath the drape has to escape at some point from around the drape; correct?
A. I don't believe that's correct, because if you will have a look at Figure -- Figure -- [Witness reviewing exhibit.]
Q. 12, 13?
A. No. I'm looking for the anesthesia blanket.
In Figure 11 there is evidence there that there's a pretty significant amount of convective heat transfer coming out in the front of the blanket. So that's another path for heat loss in addition to flow down to the bottom of the drape.
Q. I didn't give a number. I'm just saying if there's mass flow that's going underneath the drape, that mass flow -- the same amount of mass flow has to

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escape from around the drape; correct?
A. Okay. Yes.
Q. Okay. So whether or not it's 80 percent of the air or, according to, you know -- unless you -- unless you abide by Abraham where it's a hundred percent of the air comes out of the head and neck there's some certain amount of mass flow that's going underneath the drape; correct?
MR. GOSS: Object to form. You can testify about -- If you have an answer, you can provide it.
Q. Mass cannot be created or destroyed; correct?
A. Well I would agree with that.
Q. Okay. So if you have -- if you have a mass flow of air going underneath the blanket it's going to push the air out and escape as long -- as long as you have the continuous mass flow coming in through the -- through the Bair Hugger blanket; correct?
A. Whatever amount of air that does not go out to the head I presume has to go out by some other path. Maybe it goes down to the feet, maybe it goes to the bottom of the blanket. It's buoyant and it will find its easiest path of escape to get out.
Q. And once it escapes it's going to go up until it reaches some sort of equilibrium; correct?

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A. Well you have to -- I'd have to comment on that that we're now talking about air generated by the Bair Hugger blanket; am I right? That came out through the microholes.
Q. Yes.
A. All right. Just -- I'm just trying to get your -- understand your question so I can answer.
That air, as I demonstrated, is already rapidly mixing out with its surroundings, so how -- how buoyant is it? And if you look at my figures, my measurements in Figure 12 and -- well especially Figure 12, you will see that underneath the blanket the air that -- down there was only one degree above room temperature in that measurement.
Q. But other areas it's 11 degrees above temperature.
A. Around the head.
Q. Well I'm talking -- I'm looking at Figure 13.
A. Yeah. These measurements are underneath the arm-board, you're right. It's high -- It's higher than that, so --
Q. And you agree once that air escapes it's going to have some buoyant effect; correct?
A. If it's warmer than the surroundings, yes,

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--
Q. Okay.
A. -- but not otherwise.
Q. And you would agree, if we look at...
Okay. Let's look at Figures 12 and 13. Okay. You agree that over time, say in a typical 45 minute to an hour surgery, that the drape and the cotton blanket and -- will come to -- well the drape will come to some sort of equilibrium temperature; correct?
A. I think that's correct.
Q. And that temperature is going to be warmer than the ambient temperature; correct?
A. You're saying by virtue of the patient-warming blanket.
Q. Yes. I'm saying with the patient-warming blanket on.
A. That makes sense.
Q. Okay. Now --
And we agree that if air escapes at a higher temperature it's going to have a buoyant effect; correct?
A. To the extent that it's warmer than the ambient temperature, it will be buoyant.
Q. And you agree with me that the air -- the --

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what you see occurring in Figure 10, 15 -- I'm sorry -- in Figure 10 a, this buoyant -- this density is -- is because the air around or close to the Bair Hugger blanket has some buoyancy to it; correct?
A. Well I don't think so, because in this case we have the plastic blanket over it so the -- there was a discussion about conduction up through these layers, and I think what you're seeing there is the fact that the surface of the plastic blanket is warmer than --
Q. And that's what I meant.
The surface has some sort of -- creates a convection current above the -- the drape; correct?
A. It's -- It has, yeah, created a convective boundary there.
Q. Okay. And that has buoyancy pushing up; correct?
A. That is correct.
Q. And you have the unidirectional airflow pushing down; correct?
A. That's right.
Q. And that buoyancy force is going to occur along the entire drape in which the Bair Hugger is warming; correct?
A. I think so.

Q. So that would occur around the arms; correct? And to the -- And to the side.
A. Yes.
Q. Okay. So would you agree with me that that buoyancy effect, I'd like to use the word it's energy; correct? It's some sort of force.
A. Right. There's a buoyant force applied to a change in density, so, you know, that force is acting upward and being suppressed by the downflow.
Q. But my point is if air escapes out the side it could also use that buoyancy force that the drape has to force the air or any particles that it's carrying further up the drape; correct?
MR. GOSS: Just going to object that it's outside the scope of his experiment.
Q. Do you understand my question?
A. Could you repeat that, please?
Q. You have the drape that's covered that's hea -- that's been heated by the Bair Hugger and that's going to have convection currents that causes an upward buoyancy force; correct? And you're going to have air underneath the operating room table, okay, that's at a higher temperature, and when it escapes near the drape, at the edge of a drape, okay, that it's going to have some sort of buoyancy force as well

as long as it's a greater temperature than the ambient air; correct?
MR. GOSS: I think you already got him to say this.
MR. ASSAAD: I'm walking him down this.
MR. GOSS: He's not going to offer opinions about what's happening under the table.
MR. ASSAAD: Okay.
MR. GOSS: But subject to that, you can answer if you have one.
Q. As we discussed previously, if the air comes out from underneath the operating room table and it has a higher temperature than the ambient it's going to have some buoyancy force; correct?
A. Yes.
Q. And as -- if it's carrying particles, it has the buoyancy force that it has from what it collected from underneath the table, plus the additional buoyancy force around the drape pushing it up because the drape itself is creating a convection current with a buoyancy force; correct?
A. That I don't understand.
Are you claiming that the drape, at that point, is warmer than the surroundings?
Q. Yes. That's what your data shows.

A. No. The -- My data doesn't show anything about the temperature of the drape down at the sides.
Q. I'm talking about the drape right above the Bair Hugger.
A. Oh, all right.
One more time, please.
Q. Okay. I'm talking about the Bair Hugger where the drape is where we're seeing these convective currents.
A. Umm-hmm.
Q. Do you agree with me that these convective currents, if air escapes from underneath the operating room table, as we discussed, to the path of least resistance around the arms or whatever, that it's going to be -- have its own buoyant force and that it could combine with the buoyant force that's being produced by the drape to continue to rise any particles above this patient.
Do you agree with that?
MR. GOSS: Same objection, calls for speculation about a particle path.
A. Particles were not a part of our study.
Q. I understand that, but as a engineer that has done experimental fluid dynamics, and I think you know where my question is, sir, and I think -- I

understand you want to hide behind this wasn't part of our study, but I'm asking you as an engineer.
A. Well do you understand --
Q. Do you know the answer --
MR. GOSS: Move to strike.
Q. Do you know the answer to that from an engineering standpoint, "yes" or "no"?
A. Do you understand that you're asking me to speculate on something that I didn't measure and didn't consider?
Q. I'm talking about common engineering principles.
A. I really don't want to comment on particles, it wasn't part of my study. The study was airflow.
Q. So you're not an expert on particles at all.
A. Particles have been involved in some work of mine in the past, but I don't consider myself a particle expert.
Q. Okay. So you're not going to criticize Elghobashi as -- in his particle flow.
A. I criti --
My criticism of Elghobashi is in his boundary condition.
Q. Okay. As well as your criticism of Abraham too.

A. Yeah.
Q. Do you have any criticisms of Dr. Kuehn and his measurements?
A. No.
Q. You do understand that -- Wait a second.
You opined in your report that "particles in an airstream have inertia and therefore do not always follow...streamlines of the flow."
A. Could you show me where that is?
Q. Page 3.
A. Okay. Now to --
Do you want me to comment, or are you asking a question?
Q. Well, I mean, you commented on particles following airstream and having inertia.
A. We're now talking about two very different issues. The issue I think you're asking about are skin squames that -- in the air. The issue that I'm talking about here is the use of neutrally buoyant helium bubbles as flow tracers and the inertia associated with those bubbles which has basically disqualified that throughout several decades as a useful flow-visualization technique. So it's really two different things.
Q. So smoke is not a good visualization?

A. Well smoke is a better technique than the neutrally buoyant bubbles because the particles are much smaller and therefore inertia effects would be reduced.
But you have to be careful with the smoke also because it has the drawback that it -- if it's introduced at a point then you may see only one feature of the flow and you won't see the flow over here that didn't have smoke added.
Q. And turbulence would have a significant effect on smoke, correct, in smoke studies.
A. The -- It depends on the size of the smoke particle. Smoke is sometimes used in PIV, and titanium -- titanium dioxide particles that are submicron, and I believe that they demonstrate little inertia in some cases.
Q. Okay. But --
How long does the smoke, if you --
If you use smoke, how long does it last for, what's the distance that it would be visible; do you know?
A. The distance that smoke would be visible.
Q. Yeah. If it's in a high-speed or turbulent environment.
A. I have a little trouble understanding the

distance at which it would be visible. These particles aren't evaporating. If they're illuminated properly they'll be visible wherever they are.
Q. Okay. So water vapor is sometimes used for smoke; correct?
A. Fog. Water fog.
Q. Yes.
A. Yes.
Q. Would you consider that reliable?
A. Once again, being myself a proponent of optical methods that don't involve inertia on particles I'm skeptical of particle visualization techniques, including water fog.
Q. Okay. And water fog dissipiates into the air; correct?
A. Eventually, yes.
Q. Especially if it's turbulent or high velocity.
A. Yes.
Q. Okay. Do you agree that thermal sources could cause contaminated air to rise?
A. "Contaminated air"?
Q. Yes.
A. Thermal sources can cause contaminated air to rise. That's a very general statement, and I

wouldn't disagree with it.
Q. I mean, you put it down in your downflow generator. You said: "If the downflow speed is too low, contaminated air may rise from" the "thermal sources, spread, and reach the surgical site."
A. Yes.
Q. You agree with that statement; correct?
A. It's my statement.
Q. And conta --
(Interruption by the reporter.)
MR. GOSS: Is that on page 6?
MR. ASSAAD: Yes.
Q. Now contaminated air are -- is air with particles; correct?
A. Or some --
Q. And Bacteria.
A. -- other contamination.
Q. Well bacteria particles. I mean, bacteria is a particle; correct?
A. Bacteria ride on skin particles, but usually not by themselves in my understanding.
Q. Well, okay.
So going back to my last hypothetical, if contaminated air -- assuming that all air underneath the operating room table is contaminated. Can we --

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Can you agree with me on that assumption?
A. Well I don't have measurements of it, so --
Q. Let's just make the assumption all air is contaminated.
A. But if you -- if there is contamination down there then.
Q. Okay.
A. Okay.
Q. Now you agree with me that if you have contaminated air that escapes from -- warm air that escapes from underneath the drape, that the buoyant forces, if it's warmer than the ambient air, is going to rise; correct? As you wrote down here.
A. If it is warmer than the ambient air, yes, it's obvious.
Q. Till it reaches a equilibrium, and then it'll stay down and go down, correct, till it cools off.
A. I'm sorry. Once again I'm having trouble.
Q. If contaminated air is rising as the buoyant forces, okay, but it's releasing energy when it does it and releasing -- and the temperature decreases until it comes to an equilibrium with the ambient air --
A. Right.

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Q. -- and then it drops down; correct?
A. Can we put it this way? In turbulent motion it's when it -- the turbulent eddies are causing it to mix out with the cooler air and so the temperature difference fairly quickly dissipates.
Q. And --
A. That's the way I look at it.
Q. And it loses its buoyant effect.
A. It loses its buoyancy.
Q. Okay. But as long as you -- as long as it has a buoyant effect and the temperature's greater than the ambient air, it's going to continue to rise; correct?
A. Yes.
Q. Okay. So you would agree with me that if air escapes, contaminated air escapes along the sleeve and it -- it could follow along the convection currents that you've illustrated in Figure 10 along the -- along the convective currents created by the warm drape; correct?
(Interruption by the reporter.)
MR. GOSS: Object to form.
A. Could I get you to repeat that?
Q. You agree with me that --
So you would agree with me that if air

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escapes -- if contaminated air escapes along the sleeve, as we discussed, like underneath the sleeve and it escapes out, okay, it would have a buoyant effect, and as long as it's above the drape that's being heated by the Bair Hugger which forms convective currents, it would continue to rise along these thermal plumes that you show in Figure 10.
MR. GOSS: Object to form, calls for speculation.
A. I would agree with that once again with the qualification that at the time the air has gotten that far away from its heat source it's probably pretty well mixed out with the surrounding air, and therefore little temperature potential for buoyancy.
Q. But there's buoyancy along the entire drape on top of the Bair Hugger; correct?
A. On top of it.
Q. Okay. So along that whole drape if the air escapes from right around that drape to the side there's buoyant forces around the whole Bair Hugger that it could flow and be a part of.
MR. GOSS: Objection, calls for speculation, asked and answered.
Q. Agreed?
A. Yes.

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Q. Okay.
MR. ASSAAD: Do you need a break?
THE REPORTER: Yes, please.
MR. ASSAAD: Okay. Let's take a break.
(Recess taken from 5:18 to 5:22 p.m.)
BY MR. ASSAAD:
Q. Going back to Figures 12 and 13, did you perform any of the same measurements for the HotDog device?
A. We did not, and that would -- that would be a useful thing to do if the experiments were continued.
Q. Okay. So in the summary of your opinions, which is page 21, under number 4), the last sentence, you write, there are no great differences in the visible thermal behavior of the two blankets in the OR laminar downflow conditions. You're referring to what was seen from the schlieren testing above the patient; correct?
A. I'm sorry. Which -- Which --
Q. Number 4).
A. Number 4).
Q. The last sentence.
A. I'm referring to what we can see above and just slightly to the sides of the blanket.

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Q. Okay. So you're not referring to anything that could happen -- occur underneath the operating room table; correct?
A. Well as we already discussed, I don't have measurements on that.
Q. Okay. And by the way, let's go to page -- or Figure 15, which is page 16.
A. Yes.
Q. Do you know what an orthopedic surgeon wears during a total hip or total knee arthroplasty?
A. I don't know the exact garb. What we had here was a simulation of hospital garb.
Q. Okay. You're not aware of the space suits that they wear?
A. Oh, that was -- we made no attempt to do a space suit-type garb.
Q. And you agree that the space suits would affect flow coming out from -- if you're fully covered all the way down it affects flow coming out from a -- like from the shirt or the chest area.
A. If it is a total-containment suit, of course it would affect it.
Q. Okay. And that would definitely affect the images in Figures a and b; correct?
MR. GOSS: If they had been wearing a space

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suit?
MR. ASSAAD: Yes.
A. Yes.
Q. Okay. And with respect to figure C, which you used an electrocautery device, correct; right?
A. That was -- Yes.
Q. Okay. You agree with me that it's highly unlikely that there would be any live bacteria in any of the smoke that's created that rises up from the electrocautery device; correct?
MR. GOSS: Object to form, beyond the scope of his expertise.
A. I'm not a live bacteria expert so I'm speculating now, but I can also cite you -- well I can't cite specific literature right off the top of my head. There is a lot of literature about a laser cautery, rather than this device, in which the plumes are contaminated. And what exactly the nature of the contamination, whether it's bacterial or whether the smoke is -- it is caustic or what it is, but I have seen those in the literature.
Q. Well you write here that -- on number 8) on your summary: "Some OR equipment, such as electrocautery pens, create their own rising, contamination-bearing thermal plumes."

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A. Yes.
Q. You're not an expert in that; are you?
A. No, sir.
Q. Okay. So you agree with me that you're not going to be offering this testimony at trial; correct?
MR. GOSS: I'll object to form. I think the report speaks for itself.
Q. You're not an expert in it; correct?
A. I'm not an expert.
Q. Okay.
MR. GOSS: With respect to contamination.
Q. Whether or not electro -- electrocautery pens create their own rising, contamination-bearing thermal plumes.
A. I'm not an expert on -- on electrocautery pens and contamination.
Q. And you agree with me that if a physician is wearing a space suit -- Well, strike that.
You don't know what an orthopedic surgeon wears at all in a -- during a total hip or total knee arthroplasty; correct?
A. Well I realize that there are different garbs for different operating conditions, and in some cases a space suit-type garb with total containment is used. The same garb is used in some clean rooms. So

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I am not completely ignorant on this topic.
Q. Have you ever heard the term "protective effect," "protected effect"?
A. I have.
Q. In what -- In what scenario?
MR. GOSS: In relation to his work on this case?
MR. ASSAAD: In anything.
A. Heard the term, but at this point in the day I, you know, can't bring up much about it.
Q. Okay. You agree with me that the downward flow of a unidirectional airflow creates a protective effect over the surgical area in an operation.
A. Now that I see what you're getting at, that's actually addressed in my report.
Q. Where?
A. I'm not sure "protective effect" was the wording.
Q. Would it be page 6 of what I read to you before about the down -- downflow speed, about the airflow?
A. That's probably right.
Q. Okay.
A. (Witness reviewing exhibit.)
Q. The first paragraph of page 6. Probably the

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fourth line down.
A. If the downflow speed is too low, contaminated air may rise --
(Interruption by the reporter.)
THE WITNESS: I'll read it to myself.
A. If the -- this is the last par -- sentence of that paragraph: "...if the downflow speed is too high, it can suppress the natural thermal plume rising from the surgical site and impinge contaminants upon the patient and upon the surgical wound."
And that is mentioned later again because it was referenced by ASHRAE and by Int-Hout, so.
Q. You talking about the reference about thermal plumes with respect to Memarzadeh?
A. Yes.
Q. Okay. Are you aware of any other -- Do you know --
Have you ever heard of the thermal plume before this case?
A. If you'll check my list of references I have publications on the human thermal plume.
Q. Okay.
A. And a student named Brent Craven and I did, I believe, the first computational simulation of a human thermal plume.

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Q. Okay. And did you do a thermal plume of a wound?
A. No. We did not do wounds.
Q. Okay. So you don't know the effect of the thermal plume of a wound in a surgery.
A. Not directly from any work I did, just these references.
Q. Okay. And you agree with me that the airflow in an operating room, one of its purposes is to create a protective effect around the surgical site and the surgical area; correct?
A. In this sense I do agree with the term protective effect.
Q. Okay. And -- And the protect -- the airflow and the protective effect it creates is something that a lot of research has been done to determine as what you said, if it's too fast or too slow, they try to find the right flow; correct?
A. I'm aware of some research, --
Q. Okay.
A. -- the references that I cited.
Q. All right. And you would agree with me that in -- for the safety of a patient you don't want to do anything that could weaken that protective effect of the unidirectional airflow; correct?

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MR. GOSS: I'm going to object that he's not an expert in hospital HVAC.
But if you have an answer to the question, you may offer it.
A. I'm citing to references who have made that claim. I haven't actually done that myself.
Q. I understand that, but when you're -- but you agree that there -- there is a certain purpose to having a protective effect.
A. If there is a protective effect, then it certainly serves a purpose.
Q. To protect the patient from contamination; correct?
MR. GOSS: Same objection.
A. It's, yes, to protect the patient from contamination.
Q. Okay. To protect the surgeons that are putting their hands into a wound from being contaminated; correct?
A. That I am not aware of.
Q. Okay. Going back to Figure 15.
A. Yes?
Q. The first paragraph underneath the pictures you say, Figure 15b shows the same OR staff member above an empty surgical table and reveals how

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contamination gets into the recirculation region despite the fact that the staff member is properly gowned.
You have no expertise to determine whether or not that's a proper gowning technique for an orthopedic surgeon; correct?
A. That's correct.
Q. Have you seen the Bair Hugger prior to being involved in this case?
A. No.
Q. So that you don't know how a Bair Hugger is usually used in an operating room, like where it's placed.
A. I don't know or I didn't know?
Q. You don't know. You don't know what the common practice is.
A. Well I've seen the instructions for the Bair Hugger blanket, video, so I'm not completely ignorant on this topic.
Q. I understand that, but you haven't looked at many operating rooms to see how most operating rooms use a Bair Hugger.
A. The only time I've ever been in an operating room was as a patient.
Q. Okay. By the way, what was the air exchange

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rate or air change rate per hour for your setup?
A. That doesn't even --
You can't even define it in our setup, because that's only defined for a fixed room.
Q. So you can't calculate that for an open air -- for --
A. I believe the text here, I'll not look up the specific words, talks about that it's not the ACH, but it's the downflow velocity that we are trying to simulate, and we believe that's what matters as far as the interaction of patient-warming blankets and downflow.
Q. So you don't think the air exchange rate in an operating room matters with respect to contamination?
A. I didn't say that.
MR. GOSS: Object to form.
Q. In your report you mentioned about using a different setup which you could possibly use in an operating room?
A. Yes.
Q. Do you have any plans of doing that in the future?
A. It hasn't been decided.
Q. Okay. Was the $70,000 that was paid to

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FloViz for just performing these tests, or was it for future tests as well?
A. These tests.
Q. Okay. Based on our -- your testimony today is there anything that you would like to amend from this report regarding your opinions?
A. "Amend" to the report. You mean additions.
Q. No. Change.
A. Changes. Not -- Nothing I want to amend at this point.
Q. Is there anything with respect to a patient's medical records that you may receive in the future that would affect your opinions provided in this report which is Exhibit 2?
A. That's very hypothetical. I -- I have no idea what a patient's medical records would -- what effect it would have. I've not seen any patients' medical records.
Q. Are you aware that general causation discovery is closed in this case? If you know?
MR. GOSS: Object to form.
Q. Do you know?
MR. GOSS: Do you know what "general causation discovery" is?
THE WITNESS: I -- I don't know the exact

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meaning of that term.
Q. And just to be clear, you're not going to offer any testimony on infectious disease issues, orthopedic issues, nursing issues, anesthesia issues, warning issues, regulatory issues or computer -- computational fluid dynamic issues; correct?
A. No.
MR. GOSS: Object to form on the -- to the extent that it's not consistent with what's in his report.
A. I'm --
What I'm offering is what you see in this report.
Q. Okay. If you were to find out that the temperature measurement on the Bair Hugger that says 43 degrees was measured at the end of the hose and not the beginning of the hose, would that change your opinions today?
MR. GOSS: Objection, form, calls for speculation.
A. I will speculate that nothing would change except the assumed heat transfer along the hose.
Q. Well if the temperature coming out of the end of the hose is 43 degrees, instead of coming out of the blower at 43 degrees so that heat transfer that

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occurs along the hose is irrelevant to respect of the temperature of air getting into the blanket, would that affect your opinions today?
MR. GOSS: Same objection.
A. No.
Q. So it wouldn't cause you to question the fact that the air that's coming into the blanket is 43 degrees Celsius and the air coming out of the jets is between 32 and 33 degrees Celsius.
MR. GOSS: Same objection, improper hypothetical. Well it's contrary to his experimental findings, I'll say that.
A. It doesn't matter where the temperature is measured, to the end of the hose, the beginning of the hose, the temperature that I measured the jets is what I measured.
Q. But does it make sense you're going to have a 10-degree drop or -- yeah, a 10-degree drop in temperature -- 10-degree Celsius, which is a significant number, from the -- from the point of entry of air --
A. Umm-hmm.
Q. -- into the blanket to outside the perforations?
A. Yes, it makes sense to me.

Q. It does? Okay.
MR. ASSAAD: Pass the witness.
MR. GOSS: I have no questions at this time. We will --
MR. ASSAAD: I want him to read and sign.
MR. GOSS: Gabriel's going to jump -- jump ahead of me.
You have the right to review your transcript, and I recommend that you do.
MR. ASSAAD: I actually request that he reads and signs.
MR. GOSS: And -- And I join in that request.
So you will get a copy of your transcript you can review and make any changes, if you need to, within 30 days of receipt.
THE WITNESS: All right.
THE REPORTER: Off the record, please.
(Deposition concluded at 5:40 p.m.)

C E R T I F I C A T E

I, Debby J. Campeau, hereby certify that I am qualified as a verbatim shorthand reporter; that I took in stenographic shorthand the testimony of GARY S. SETTLES, PH.D. at the time and place aforesaid; and that the foregoing transcript consisting of 350 pages is a true and correct, full and complete transcription of said shorthand notes, to the best of my ability.

Dated at Lino Lakes, Minnesota, this 22nd day of July, 2017.

DEBBY J. CAMPEAU
Notary Public

S I G N A T U R E P A G E

I, GARY S. SETTLES, PH.D., the deponent, hereby certify that I have read the foregoing transcript, consisting of 350 pages, and that said transcript is a true and correct, full and complete transcription of my deposition, except per the attached corrections, if any.

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Date Signature of Witness

WITNESS MY HAND AND SEAL this _____ day of _____, 2017.

(DJC) _____